The Innovative School: Putting Computers To Good Use

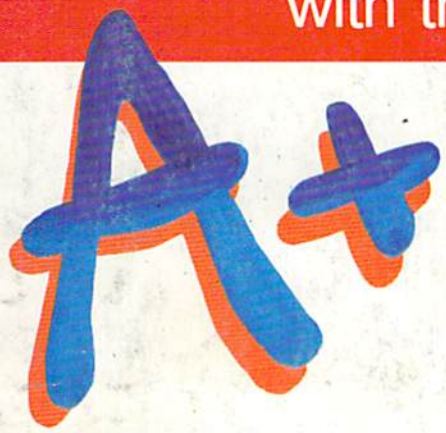
COMPUTE!'s GAZETTE

$2.95
October 1985
Issue 28, Vol. 3, No. 10
02220 $3.75 Canada

FOR **COMMODORE** PERSONAL COMPUTER USERS

X BASIC:

Add 33 enhanced BASIC commands to your 64 with the program in this issue



Picking The Right Printer

There are dozens of excellent printers available. Here's how to decide which one's best for you. (And how to set it up when you get it home.)

Also In This Issue:

Hints & Tips: Problem Solvers

Simple Answers To Common Questions

Software Reviews

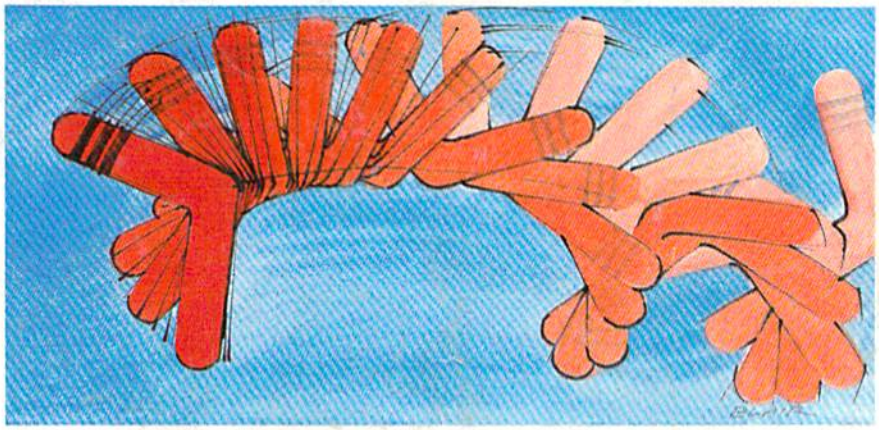
And More

Gradebook

A fast, full-featured organizational tool for teachers. Both a database and a spreadsheet. For the 64.

C: Language Of The Future?

Fast and flexible, C is emerging as a popular applications programming language.



Turnabout

Offense or defense? Everyone plays this unique 64 strategy game a little differently.

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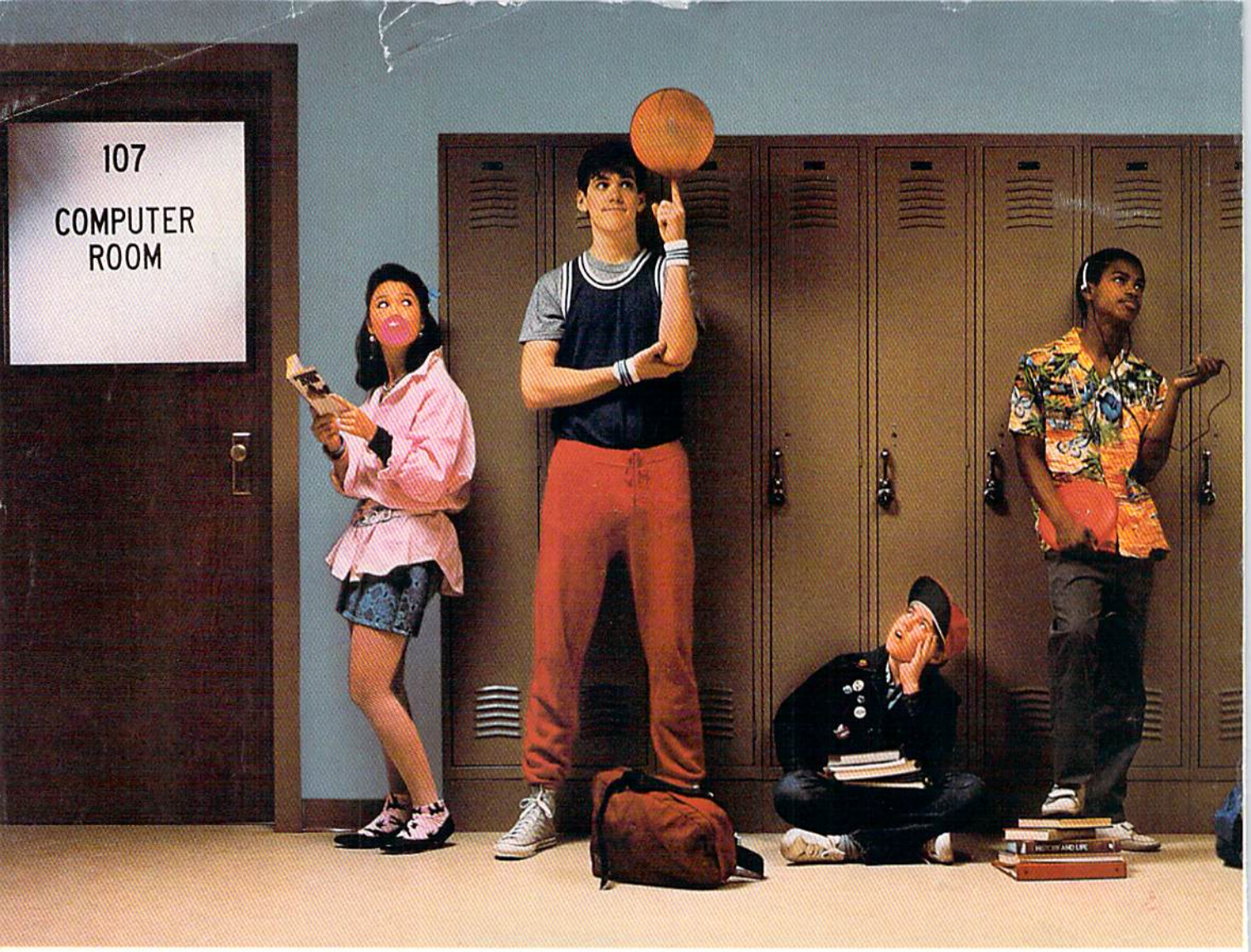


With Commodore 128's instead of Apple IIc's, these kids would be on computers instead of in line.

Meet the Commodore 128.™ The new personal computer that's already destined to be at the head of its class. It not only outsmarts the Apple® IIc in price, it comes out way ahead in performance.

A lower price is welcome news to any tight school budget. But it's not the only way the 128 saves you money. You only need to buy one external disk drive to network eight Commodore 128's from a teacher's desk. The Apple IIc has a built-in disk drive. That adds a built-in extra cost for a feature your classroom doesn't really need. There's even more to the Commodore 128 than being able to put more students on computers for less money.

There's more intelligence.

As your students grow smarter, so does the Commodore 128. It's a computer they'll find more useful because it's capable of expanding from 128K to 512K memory. The Apple IIc doesn't expand, making it less versatile. It also doesn't have the Commodore 128's expanded keyboard that offers more commands for easier programming and more varied use of graphics and text. Or a numeric keypad that's a real necessity when using a computer in math or science classes.

More software.

The Commodore 128 is one new personal computer you won't have to wait for software

You communicate – and the story responds – in full sentences. Which means that at every turn, you have literally thousands of alternatives. So if you decide it might be wise, for instance, to wrap a towel around your head, you just say so:

>WRAP THE TOWEL AROUND MY HEAD

And the story responds:

THE RAVENOUS BUGBLATTER BEAST OF TRAAL IS COMPLETELY BEWILDERED. IT IS SO DIM IT THINKS IF YOU CAN'T SEE IT, IT CAN'T SEE YOU.

But be careful about what you say. Or one moment you might be strapped down, forced to endure a reading of the third worst poetry in the galaxy; the next you could be hurtling through space with Marvin the Paranoid Android aboard a stolen spaceship.

And simply staying alive from one zany situation to the next will require every proton of puzzle solving prowess your mere mortal mind can muster. Even simple tasks can put you at wit's end:

>OPEN THE DOOR

And the story responds:

THE DOOR EXPLAINS, IN A HAUGHTY TONE, THAT THE ROOM IS OCCUPIED BY A SUPER-INTELLIGENT ROBOT AND THAT LESSER BEINGS (BY WHICH IT MEANS YOU) ARE NOT TO BE ADMITTED. "SHOW ME SOME TINY EXAMPLE OF YOUR INTELLIGENCE," IT SAYS, "AND MAYBE, JUST MAYBE I MIGHT RECONSIDER."

Other interactive science fiction stories from Infocom include PLANETFALL,™ in which you're stranded on a mysterious deserted world. STARCROSS,™ a puzzling challenge issued eons ago and light-years away. SUSPENDED,™ the race to stabilize an entire planet's life support systems. And A MIND FOREVER VOYAGING,™ a radically new work of serious science fiction in which you explore the future of mankind.

DON'T PANIC!

But don't panic. You'll be accompanied every light-year of the way by your trusty Hitchhiker's Guide, which you can always depend on for up-to-the-nanosecond information. Well, almost always:

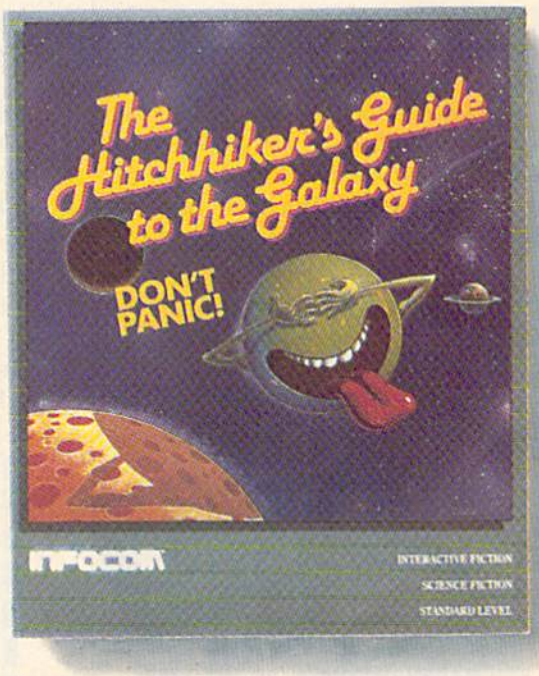
>CONSULT THE HITCHHIKER'S GUIDE ABOUT THE MOLECULAR HYPERWAVE PINCER

And the story responds:

SORRY, THAT PORTION OF OUR SUB-ETHA DATABASE WAS ACCIDENTALLY DELETED LAST NIGHT DURING A WILD OFFICE PARTY.

So put down that beer, take that towel off your head, open the door, hitchhike down to your local software store today and pick up THE HITCHHIKER'S GUIDE TO THE GALAXY. Before they put that bypass in.

Still not convinced? Try our Sampler Disk which includes portions of four different types of stories for a paltry $7.95. If it doesn't get you hooked on the addictive pleasures of Infocom, return it for a full refund. If it does, you can apply the price toward any Infocom story. You can't lose!



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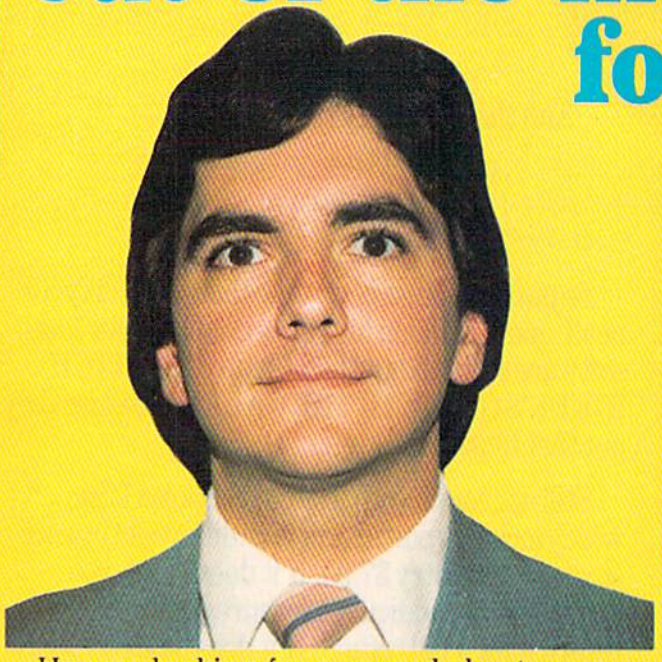
says Tony Muscarella.



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Tony is a CPA, and works in Windsor Locks, CT. Tony bought his Calc Result two years ago. He was looking for a spread sheet program for the Commodore and found Calc Result.

"I think Calc Result is the best spread sheet on the market. It is very easy to use and logically built up. I have found the capacity I need in the program, and you can understand I have some demands, as I am an accountant. I did not believe that a homecomputer equipped with Calc Result could be so powerful.

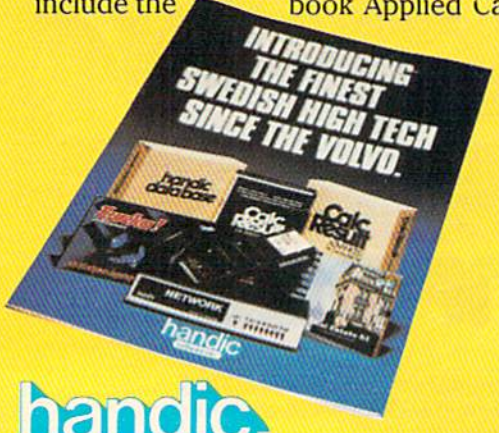
I use the program for business as well as at home. The most frequent business use is loan amortization. With Calc Result it is a lot faster to see the status of a loan, and also how a change in the amortization will affect the payment time.

Calc Result showed me how a slight increase of 10—20 dollars per month on the house amortization could cut 10 years out of the amortization period for my house. Incredible!

Calc Result is a program that is very easy to use, and very powerful. I can really recommend it."

If you want some more information about Calc Result or any of Handic's products for Commodore 64, send in the coupon or call.

Calc Result is available in two versions, the Advanced version with 32 pages (discdrive required), or the Easy version (cartridge-based). Order either of the programs NOW, and we will include the book Applied Calc Result (value $14.95) for free.



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*=General, **V**=VIC-20, **64**=Commodore 64, **+4**=Plus/4, **16**=Commodore 16, **128**=Commodore 128

COMPUTE!'s GAZETTE is published monthly by **COMPUTE!** Publications, Inc., Post Office Box 5406, Greensboro, NC 27403 USA. Phone: (919) 275-9809. Editorial offices are located at 324 West Wendover Avenue, Greensboro, NC 27408. Domestic Subscriptions: 12 issues, $24. Send subscription orders or change of address (P.O. Form 3579) to Circulation Dept., *COMPUTE!'s GAZETTE*, P.O. Box 10957, Des Moines, IA 50340. Second class application pending at Greensboro, NC 27403 and additional mailing offices. Entire contents copyright ©1985 by **COMPUTE!** Publications, Inc. All rights reserved. ISSN 0737-3716.

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editor's notes

The Commodore 64, first introduced in 1982, went on to become the world's most popular computer. Now, nearly four years later, a new generation of computers is just arriving at the retail stores. What will this mean to the millions of 64 owners?

There's been a great deal of excitement recently over Commodore's new Amiga computer. It has extraordinary graphics and sound capabilities, great speed, multitasking, a large memory, and sophisticated operating systems and language support. Will this new machine eclipse the best-selling computer of all time? Will Commodore continue to support the 64, or turn it into an "orphan?"

Commodore will not release sales figures, but the 64 ad campaign shows no signs of slowing down, and reliable industry insiders observe that sales of the 64 and associated software and peripherals continue to be strong. Commodore has officially stated that it will continue to sell the 64 and continue to support it with software and replacement parts.

Other personal computers have withered relatively quickly after the introduction of a strong, new-generation challenge. The original Commodore PET computer, for example, was relegated to obscurity by the introduction of the VIC and later the 64. It is now nearly impossible to find software, magazine articles, or books for the PET.

However, this phenomenon is dependent on scale: A large base of owners gives a machine impetus. The VIC, of course, is still covered in this magazine and others, and is still supported by books and software. Sales of the VIC continue overseas. What is true of the VIC is even more true of the 64. With an estimated installed base of over three million, the 64 will continue to be supported, regardless of the market performance of the new Amiga.

This support will, of course, also continue in the GAZETTE and in COMPUTE! Books. We will continue to bring you the best utilities, the most exciting games, the most informative columns, and fullest coverage of the 64 available. In this issue, "X BASIC" will greatly expand your 64's BASIC. It adds 33 commands that make programming graphics and sound much easier. If you're a teacher, you'll doubtless find many uses for "Gradebook," a powerful organizational tool for teachers. It's fast, flexible, and has many features usually found only in spreadsheets and databases.

Also, there are three excellent games: "The Farm Game," "Turnabout," and "Atom Shoot." There are versions of "Farm" and "Atom" for four different computers—64, VIC, Plus/4, and Commodore 16.

Upcoming issues will include a short and extremely powerful assembler; "Preview-80," a *SpeedScript* enhancement program which lets you see on screen exactly what your document will look like when printed; "Backgammon" and "Power Poker," full simulations of the popular traditional games; useful disk utilities, and much more.

Commodore expects sales of the 64 to continue to be strong and COMPUTE! Publications will continue its coverage of this computer. Although the Amiga is an extraordinary computer, it cannot collapse the huge audience of 64 owners. The 64 is, after all, the most popular computer ever.

Richard Mansfield

Senior Editor

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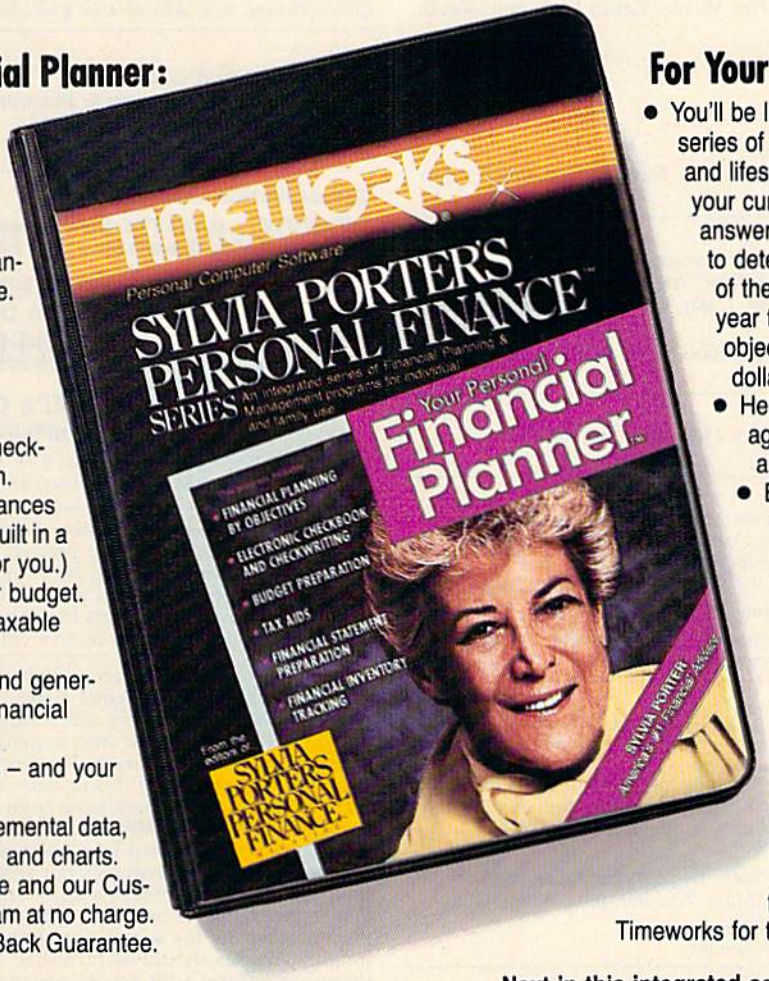

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COMPUTE! Publications, Inc., publishes
COMPUTE! **COMPUTE! Books** ***COMPUTE!'s GAZETTE***

Corporate Office:
324 West Wendover Ave., Suite 200, Greensboro, NC 27408

Mailing Address:
Post Office Box 5406, Greensboro, NC 27403

Distribution Center
500-A Radar Road, Greensboro, NC 27419

Telephone: 919-275-9809
Office Hours: 8:30 AM to 4:30 PM Monday–Friday

Member ABC Audit Bureau of Circulations

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Subscription Information

COMPUTE!'s GAZETTE Circulation Dept.
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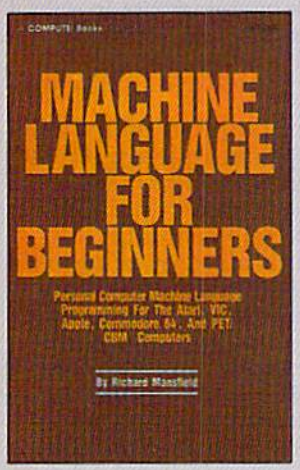

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Richard Mansfield

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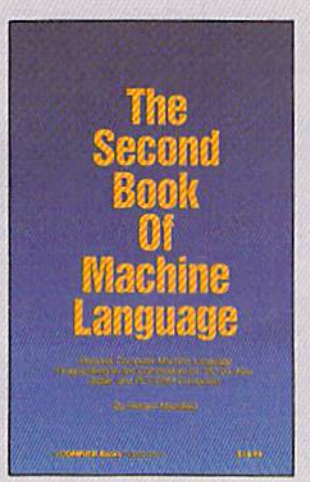

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Richard Mansfield

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Do you have a question or a problem? Have you discovered something that could help other Commodore users? Do you have a comment about something you've read in COMPUTE!'s GAZETTE? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403. We regret that due to the volume of mail received, we cannot respond individually to programming questions.

Safety Saves

The "MLX" program allows you to type part of a machine language program, save it to disk, and return later to complete it by listing the new line. Are there any commands available to do this with BASIC programs?

Ancel W. Norris

It's a good idea to periodically save a copy of a program you're working on, whether it's in BASIC or machine language. Computer memory is active only as long as the power is on. If the power were to fail, even for a brief moment, you would lose everything you had typed since the last save. Some people make a safety save every ten minutes, while others may wait half an hour.

The "MLX" program does two things when you type SHIFT-S to save. First, it takes the program name you've chosen and tries to scratch a program by that name from the disk (if there's no program under that name, nothing happens). Then it saves the new copy of the program.

The reason for scratching first is that the disk drive does not allow you to save a program if there's another program with the same name already on the disk. If a disk contained two programs named "adventure" and you tried to **LOAD"0:ADVENTURE",8** *the disk drive wouldn't know which program you wanted.*

*So if you're accustomed to using the same name for partially typed MLX programs, you'll have problems saving unfinished BASIC programs. You could scratch the earlier version before saving, or just number the different versions of a program: ADV1, ADV2, ADV3, and so on. When you've finished, use the question mark wild card to scratch all of the earlier versions (***OPEN 15,8,15, "S0:ADV?"** *will scratch all programs with a four letter name beginning with the letters "ADV"). But make sure you don't scratch the final version—give it another name or save a copy to another disk.*

Joystick Rapid Fire

Several months ago, "Gazette Feedback" said POKE 650,128 makes keys repeat when they're held down. Is there a POKE to give rapid fire for the joystick?

Brian Patz

The fire button is an electrical switch. As long as you hold down the button, the circuit is live. So, in a sense, the joystick button already repeats.

So why do some games make you press the button again and again to get rapid fire? Many such programs look first for the button to be pressed and then take the appropriate action (a character jumps, a laser is fired, or whatever). The program then waits for the button to be released. You would have to rewrite parts of the software to allow a rapid fire effect. It might also be possible to alter the wiring of the joystick to cause the button to send pulses rather than a steady current. A modification like this would cause the button to repeat. But there isn't a single POKE you can enter; you have to change either the software or the joystick.

Unusual Lines

I have two questions about "Dynamic SID Editor" in the June issue. How is it possible to use just one quote mark in a PRINT statement (line 50310)? And what is the purpose of starting a line with a colon (line 50330)?

Dennis R. Waldron

Quotation marks signal the beginning and end of a string to be printed, **PRINT "LIKE THIS"** *for example. The second quotation mark is required if you want to add a colon and another command to the line. But if it's the last item on a line, the second quote is unnecessary. The computer assumes that the end of a line is also the end of a print statement. The technique of leaving off the final quotation mark is often found in programs for the unexpanded VIC because it saves one byte of memory.*

Colons, like quotes, are also delimiters; they separate commands on a line. BASIC automatically throws away extra spaces between a line number and the first command on the line. But if a line begins with a colon, you can add as many spaces as you want. Some programmers like to indent FOR-NEXT loops using colons followed by spaces because it makes listings easier to read. You can also put a single colon on an otherwise blank line or two, to separate different sections of a program.

Starting A User Group

There are 20–30 Commodore owners in my area, but no user groups in sight. I was wondering if you could give me some tips on starting one.

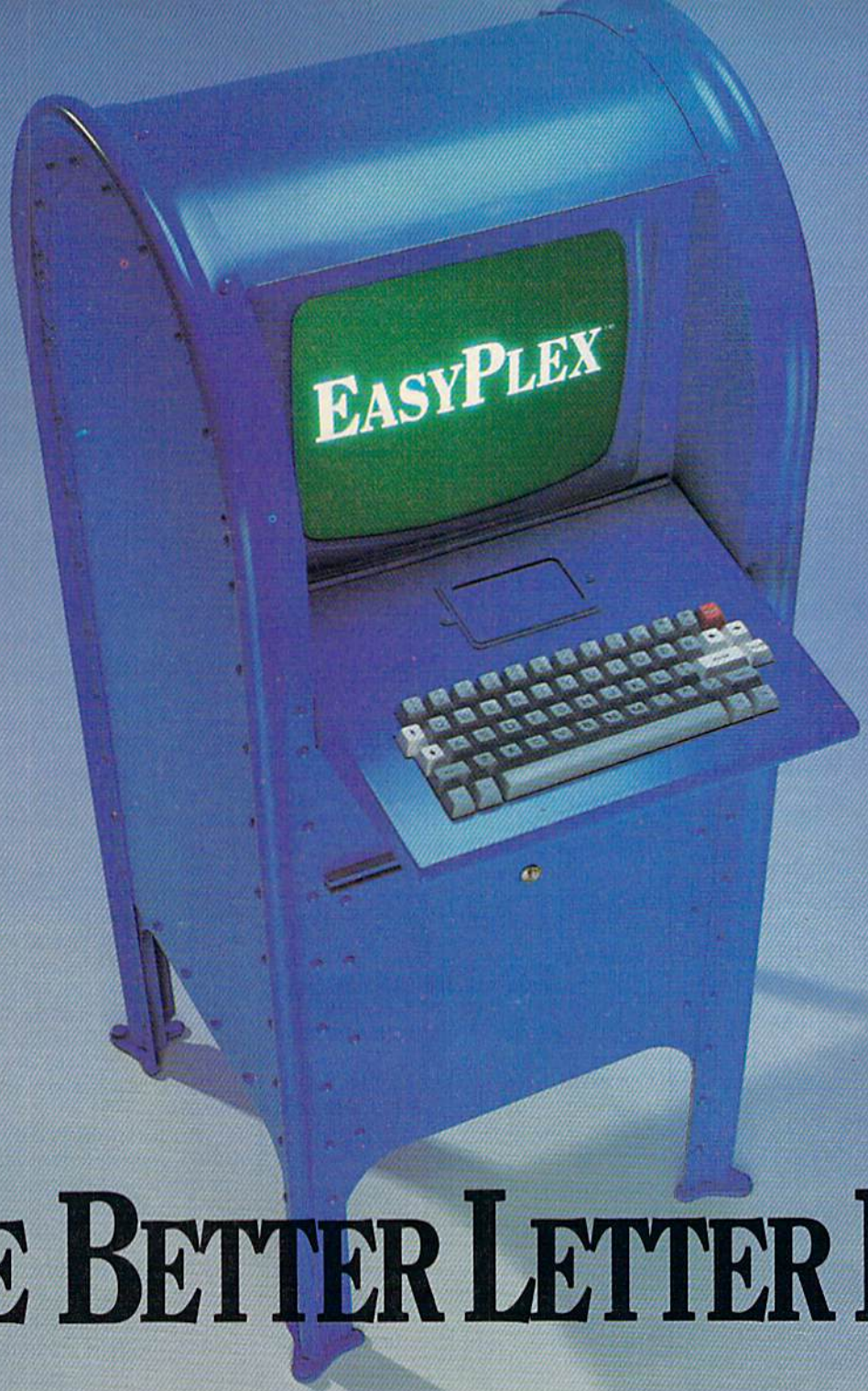
Mike Scott

All you need to start a user group is several interested people, someone who is willing to do the initial organizing, and a place to meet. It sounds like you already have the first two requirements.

Set a time and place for your first meeting. It could be at someone's home (if you think the group will be small enough), a school classroom, the back room of a local computer store, or anyplace else that is available. Advertise the meeting by posting notices in public places—stores, laundromats, restaurants, schools—and try to get the notice printed in your local newspaper or announced on a radio station. Also, some cable TV systems have a public notice channel for various announcements.

Your first meeting will probably be spent determining the group's interests and goals. Officers will need to be appointed or elected. They'll be responsible for planning and leading future meetings, and taking care of other administrative tasks. You could have everyone fill out a sheet indicating what kind of equipment they own, what they want from the group, and also what they feel they could contribute. Suggestions for content of future meetings is also important.

Each meeting should allow time for two things: information for the group members (software reviews, news from Commodore, demonstrations of peripherals, tutorials, speakers on topics of interest, etc.); and input and questions from the group members. Stay in close touch with the group, and modify the structure when necessary (breaking off into subgroups for special interests, or starting a



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bulletin board system to facilitate better communication, for example).

Some user groups arrange for discount rates on blank disks or group purchases at a lower price than software from local computer stores. In some states or cities you may have to obtain a tax permit or vendor's license to legally sell items like this. Most groups also maintain a library of public domain software—programs written by members and donated to the user group for free distribution to other members.

You may want to get in touch with other user groups to see how they got started. Commodore provides support to user groups—contact Pete Baczor, Commodore Business Machines, 1200 Wilson Drive, West Chester, PA 19380, (215) 431-9264.

Another Way To Quash Question Marks

In the March issue someone asked about how to get rid of the question mark in an INPUT statement. Your suggestion of OPENing a file to the keyboard is one way to do this. Here's another:

```
10 POKE19,1
20 INPUT"=>";A$
30 POKE19,0:PRINT:PRINTA$
```

Location 19 controls whether or not a question mark is printed. The PRINT is needed to move the cursor to the next line. I hope this method is useful to your readers.

Louis M. Rastelli

Thanks for the tip.

Reading Trivia Randomly

How can I READ random items in DATA statements to make a trivia program?

Dan Lackey

Reading from DATA statements is sequential, which means the computer starts reading at the beginning and continues until there are no more DATA statements. It's possible to reset some pointers, to jump into the middle of a group of DATA statements (see "Hints & Tips" in the September issue for more details), but there's a much easier way.

First, put all the data into an array. An array is like a numbered list. You can then pick a number at random and look up that item in the array. Here's a simple trivia program:

```
10 READA$:IFA$<>"END"THENT=T+1
   :GOTO10
20 T=T/2:DIMQ$(T,1)
30 RESTORE:FORJ=1TOT:READQ$(J,
   0),Q$(J,1):NEXT
40 R=INT(RND(1)*T+1):PRINTQ$(R
   ,0)
50 FORJ=1TO2500:NEXT
60 PRINTQ$(R,1):PRINT:GOTO40
100 DATACAPITAL OF NEBRASKA,LI
    NCOLN
110 DATAMOUNTAINS BETWEEN FRAN
    CE AND SPAIN,PYRENEES
120 DATAPRESIDENT AFTER TRUMAN
    ,EISENHOWER
130 DATAEND
```

Each DATA statement has one question followed by a comma and the answer. You can add to or change the data as you like, as long as the last statement contains an END. Line 10 READs through all the DATA statements until it finds "END." Line 20 DIMensions the array according to how many questions and answers were found in line 10. In line 30 the two-dimensional array is filled with the questions (Q$(J,0)) and answers (Q$(J,1)).

Line 40 prints a question, 50 is a delay loop (time enough for someone to call out an answer), and line 60 prints the answer. Add a scoring routine and some more questions and you'll have a workable trivia program.

VIC Expansion

I've been looking for 8K or 16K memory expansion for my VIC-20. A mail order company lists them but doesn't have them in stock. The May GAZETTE requires at least 8K for the VIC programs. Where can I find VIC memory? I don't want a 64.

Robert Day

We called the toll-free Commodore customer support line at 800-247-9000. They said Commodore has VIC expanders in stock, and you can order directly from Commodore in Pennsylvania (or ask your Commodore dealer to order for you). Also, some stores still carry 8K and 16K VIC memory expanders.

One Letter At A Time

I write programs that use a lot of printed messages. In several commercial programs I have seen messages that are printed letter by letter, which looks better than just having messages appear. How would I add this feature to a program?

Kevin Smith

What you're asking for is fairly easy to do with the MID$ function and a delay loop. MID$ breaks a string into a smaller string. For example, **N$ = "ABCDEFG": PRINT MID$(N$,2,3)** *would print "BCD" because the MID$ function started at the second position within N$ and continued for three characters. To pull out individual characters, use a 1 as the second number. Here's the subroutine you need:*

```
10 A$="LETTERS ONE BY ONE":GOS
   UB500
499 END
500 FORJ=1TOLEN(A$):PRINTMID$(
    A$,J,1);:FORK=1TO500:NEXTK
    ,J:PRINT:RETURN
```

Whenever you want to print a string one letter at a time, put it into A$ and GOSUB 500. Change the length of the K loop for longer or shorter delays. If you're feeling ambitious, you could add a short sound after you print each letter and a random length delay loop, to make it sound like a typewriter.

Adding And Subtracting Line Feeds

I typed in one of your programs that allows you to print out the results. The problem is that everything prints on the same line. The paper doesn't advance. How can I add a line feed instruction?

Joseph O'Keefe

I own a daisywheel printer. Regardless of the software I use, I'm unable to print a spreadsheet or letter without it being double spaced. Is it possible to suppress the extra linefeed?

Ronald J. Belanger

The problem of too many or too few linefeeds is fairly common. To fix it, you'll have to adjust one of the DIP switches on your interface. Check the interface manual for the exact settings.

Pressing RETURN causes the screen cursor to move to the beginning of the next line down. But the term "carriage return" for this action originally described the return of the printer carriage (the part that does the printing) to the beginning of a line. Some printers need two instructions: first return the carriage, then feed the paper one line up. The ASCII code for a carriage return is CHR$(13), ASCII for a linefeed is CHR$(10). But on other printers, the two actions are combined—a CHR$(13) causes a carriage return plus *a linefeed.*

Because printers use one or the other method, most interfaces allow you to set whether or not a linefeed is added to every carriage return.

PEEKing The Joysticks

I have both a VIC-20 and a 64, and would like to know how to PEEK the joystick inside a program.

Patrick Toal

The following statement can be used to read the value of joystick port 2 on the 64 (for port 1, change the 56320 to 56321):

J=15−(PEEK(56320) AND 15)

The values of J can be interpreted as follows:

0 - nothing
1 - up
2 - down
4 - left
5 - up and left
6 - down and left
8 - right
9 - up and right
10 - down and right

To read the joystick fire button, use

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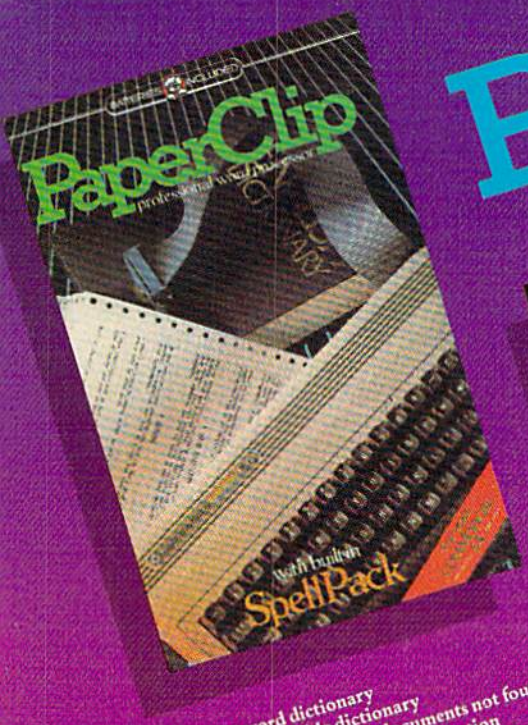

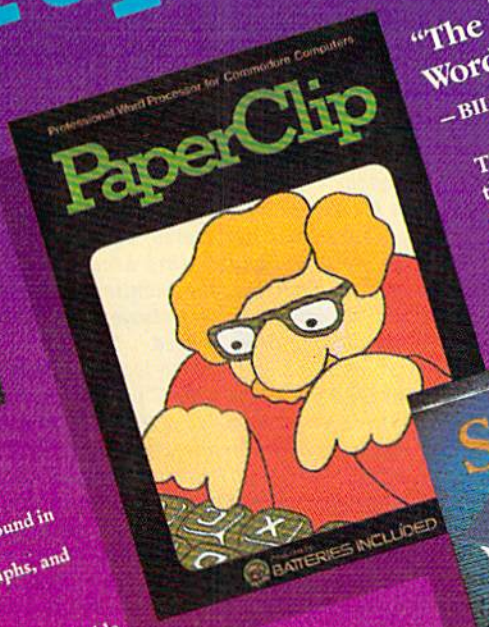

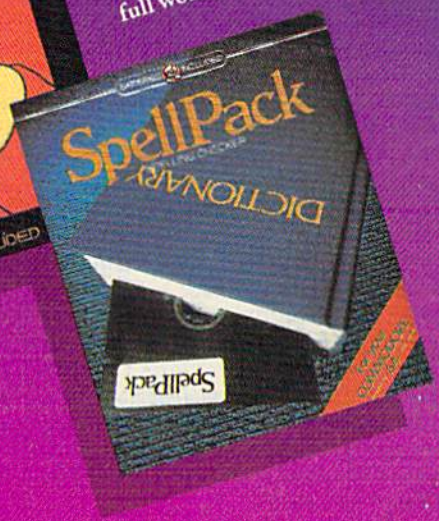

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this expression (for joystick 1, change 56320 to 56321):

IF (PEEK(56320) AND 16)=0 THEN the fire button is pressed

The VIC joystick is a little more complicated to read because one of the memory locations is needed for reading the keyboard. Use the following line to read the VIC joystick (the values of J will be the same as above):

POKE 37139,0: POKE 37154,127: J=15-((PEEK(37137) AND 28)+(PEEK(37152) AND 128)/4)/4: POKE 37154,255

Use the following expression to find out if the fire button is pressed:

IF (PEEK(37137) AND 32)=0 THEN the fire button is pressed

The Plus/4 and 16 have a built-in BASIC statement, JOY(n), to read the joysticks.

Writing Adventure Games

One of my friends is writing a text adventure game like *Zork*. I would like to write one of my own, but don't understand how to use random files. Please explain random files.

Brant Phillips

SAVE and other file handling commands like LOAD, OPEN, PRINT#, INPUT#, and GET# are high-level commands, because a single command does a lot of work. The computer takes care of the details like reading through memory from the beginning to the end of the program. The disk drive gets the signals, transfers them to the disk, puts a new entry in the directory, and protects the sectors used by the program.

Random files, on the other hand, are low-level because you have to do all the work. They're not even really files, they're just reading and writing directly to disk.

Let's say you want to create a random file. First, you would open a memory buffer in the disk drive, write to it, and copy the buffer to a sector on disk. To read it, open a buffer, copy from disk to the buffer, and read the buffer.

Now things get complicated. There will be no entry in the disk directory, you'll have to remember which track and sector you used. If you accidentally choose a sector that's part of a program file, the program will be overwritten. If you choose a safe sector, it may later be scrambled by a file (because the block has not been allocated). You could use the block-allocate command (B-A), but it contains a bug. If you try to allocate a block that's already allocated, the whole track will be allocated.

Random files are complicated and messy. There's no real advantage to using them in an adventure game. You'd be better off with either sequential or relative files.

49152—The Magic Number

Why do so many of your machine language programs start with SYS 49152? Isn't it possible to use other areas of memory or SYSes? When two programs use the same locations, you can't merge or append one ML program with another to get the maximum use from your computer.

G. Gorham

There's nothing magic about the number 49152. You can put a machine language program almost anywhere in memory. But many machine language (ML) programmers use location 49152 because it's a safe place to put a program. The 4096 bytes of memory from 49152 to 53247 (hexadecimal $C000–CFFF) were intended to be a safe zone; BASIC doesn't use this area for anything (although many programs on cartridge use this part of memory). Locating ML programs here helps ensure that they won't get in the way of BASIC, and vice versa.

Another good place for machine language is the cassette buffer, located at 828–1019 ($033C–03FB) on both the 64 and the VIC. BASIC uses the cassette buffer for temporary storage during tape operations. At other times, it's just free memory. However, this area is much smaller than the one mentioned above, and its contents are destroyed whenever the cassette drive is used.

A third option is to locate a routine somewhere in the BASIC program space, which stretches from 2049 to 40959 ($0801–$9FFF) on the 64, or 4097–7679 ($1001–1DFF) on the unexpanded VIC. Using part of BASIC memory can be hazardous, though, since BASIC programs need it for storing variables. If you're careless, it's easy to crash your computer by putting ML into locations already used for something else. Or, you may cause a crash if you let part of your BASIC program (like dynamic strings) write over the machine language.

You can prevent interference by carving out a protected zone for your ML program within the BASIC program area. Locations 55 and 56 hold a two byte pointer address that tells the computer where BASIC user RAM ends. By lowering the value in this pointer, you can keep BASIC from using any of the locations between your new top of memory and the "real" top of memory. Another thing you can do is move up the bottom of BASIC program memory by changing the pointers at 43 and 44.

Finally, you can use an advanced method called bank switching, which lets you use the RAM memory locations underneath the BASIC or KERNAL ROM. Theoretically, you could write a program for the 64 that uses all 64K of available memory. The problem with bank switching is that since BASIC is turned off, the program must be written entirely in machine language.

So ML programmers like to start programs at 49152 because the cassette buffer is often too small, BASIC RAM can be hazardous, and bank switching is complex.

Your last comment points up a perennial problem—where to put ML programs (especially utilities). The memory at 49152–53247 and 828–1019 is convenient, so most ML programs are put there. If both of your favorite utilities start at location 49152, however, you probably can't use them together.

If one of the programs is relocatable, you may be able to move it to a different part of memory. It's difficult to make programs completely relocatable because you have to avoid two useful instructions: JMP and JSR (similar to BASIC's GOTO and GOSUB). And even if you have a relocatable program, it may interfere with the operation of the other program.

Color Nybbles

I think there's something wrong with the PEEK command. If I enter POKE 1024,2: POKE55296,1, a white "B" appears in the upper lefthand corner. But PRINT PEEK(55296) results in 193, 81, 241, or some other numbers. If you POKE a 1 into color memory, shouldn't PEEK show that there's a 1 there? Is the computer defective or am I doing something wrong?

Austin J. Moe

There are a few cases, including color memory, where PEEKing doesn't give you quite the right number. A Commodore 64 has 16 colors, numbered 0–15, so color memory is wired for only four bits rather than eight. Four bits, half a byte, is called a "nybble." When you PEEK color memory, the low nybble is correct, but the high nybble will contain random values because those four bits are not hooked up.

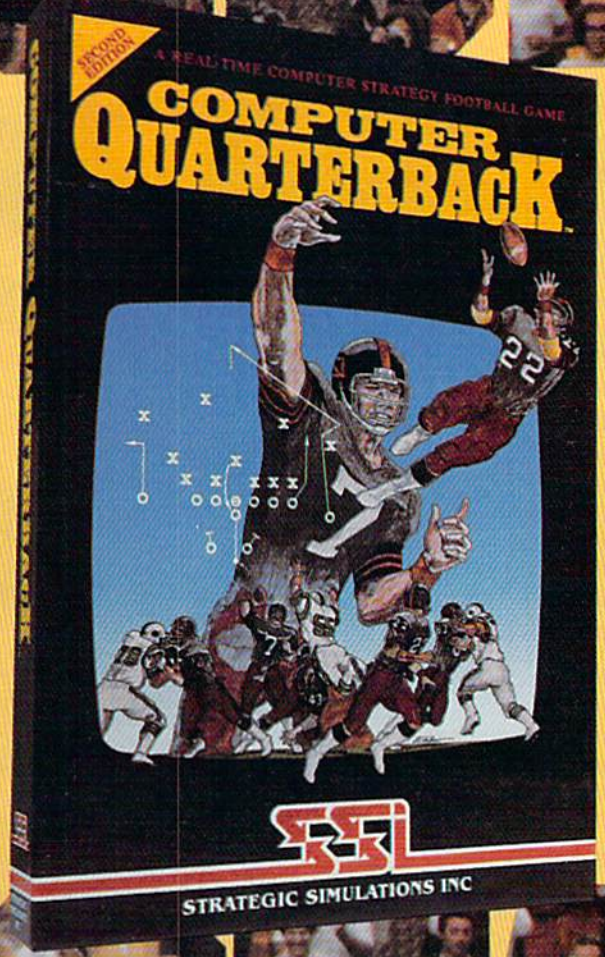
To strip off the top four bits, enter a modified PEEK: **PRINT PEEK(55296) AND15**. *The AND function should take care of your problems.*

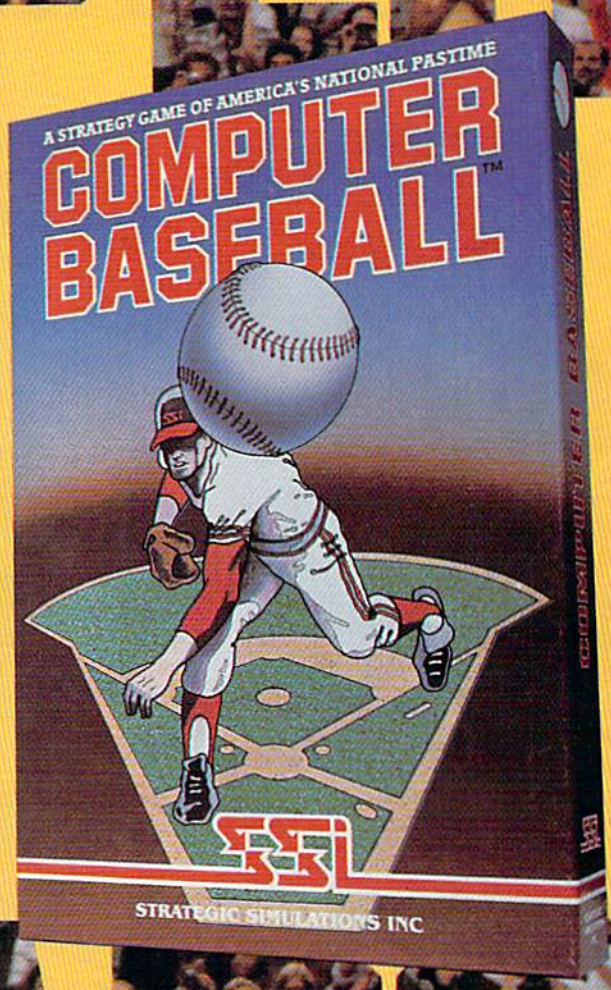
Another instance where PEEK won't work is the SID chip (the chip that creates sound on the 64). You can't PEEK into the registers there. The POKEs to make a sound do not go to regular memory, they're fed directly into the SID chip. PEEKing that area yields numbers unrelated to the values POKEd there. You might call it write-only memory.

Moving BASIC Around

I'm writing a 64 program that uses custom characters, but the program is overrunning the character set. The *Programmer's Reference Guide* says the highest location for the start of a character set is 14336, but it's still not high enough in memory. I tried **POKE**

SUPER STARS





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56,48:CLR and got an out of memory error. How can I move the bottom of BASIC up to 4096 or thereabouts so I can put the characters at 2048?

Walter Wright

On a 64, BASIC programs fit into memory beginning at 2049 (the "bottom" of BASIC) and ending at 40959 (the "top"). Whatever memory is left over can be used by variables. It's quite possible that your variables are interfering with the custom character set.

*On the VIC, 64, Plus/4, and 16, locations 43–44 point to the bottom of BASIC, while 55–56 point to the top. By POKEing a 48 into location 56 (followed by a CLR, which is necessary when you lower the top of memory), you moved the top of BASIC all the way down to 12288 (48*256), which leaves only about 10K of memory for your BASIC program.*

It would be preferable to leave the top of BASIC untouched and move the bottom up. This line will do just that:

POKE 44,64: POKE 64*256,0: NEW

*Now you can load the custom characters program; the variables won't interfere with the character definitions. The beginning of BASIC has been moved to 64*256, which is 16384. If you prefer to put BASIC at 4096 (16*256), change the 64 to 16 in the two POKEs.*

The Save-With-Replace Bug

In your February issue you wrote about the save-with-replace bug. I too have come across the problem.

I was working on a program called "ESF" when I remembered that I needed to change something in another program called "ARTILLERY." So I used save-with-replace on the current copy of "ESF," loaded "ARTILLERY," made a change, and saved-with-replace. Later, I tried to load "ESF" but got "ARTILLERY" instead. My best guess is that the program is still there, but I can't get it off the disk.

Matthew Whiting

The Commodore save-with-replace command **(SAVE "@:filename",8)** *has been the focus of controversy for years. Some experts have steadfastly denied that there is anything wrong with it.*

There was no hard proof of a bug—until now. The full details will be published in an upcoming issue of our sister magazine, COMPUTE!. *Here's a brief explanation:*

Save-with-replace does several things. First, the new copy is saved (if there's not enough room on the disk for a complete copy of the program, you'll have problems, of course). Each filename in the directory contains a pointer that indicates where to find the program, so the directory is changed to point to the new version of the replaced program. Finally, the block allocation map (BAM) is updated. Disk sectors used by the old version are marked as free, while the sectors occupied by the new version are marked as allocated. The routine to update the BAM is where the bug happens.

In certain situations, the BAM is incorrectly written back to the disk. Right after a faulty save-with-replace, the program name is in the directory, the pointer to the program is correct, and the new version is on the disk. You can load the program and even verify it. But the blocks used by the program are not allocated. The next time you save a program, it may be put into those blocks, and your previous (replaced) program is gone and cannot be recovered. If you load the directory, the number of blocks used by programs plus the number of free blocks should total 664. When the bug happens, the total is often more than 664.

The roots of the problem go back to the PET dual drives (drives 0: and 1:). The disk operating system (DOS) of the 1541, a single drive, was translated and modified from the original dual drive DOS. So there's a sort of "phantom" drive 1 in the 1541. One expert on the Commodore DOS has said the 1541 spends half its time convincing itself that it's drive zero and not drive one. Sometimes the 1541 mistakenly sets aside a buffer for the phantom drive, which can, under certain circumstances, lead to the SAVE@ bug.

There are three ways to avoid the bug, and safely save-with-replace. First, you can validate the disk after every save-with-replace. This isn't such a good solution because it often takes more time than scratching the old version and doing a regular SAVE.

The second solution is to always *use the "0:" prefix when you use the disk. Here are some examples:*

```
LOAD "0:programname",8
LOAD "$0",8
SAVE "0:programname",8
OPEN 15,8,15,"I0"
```

*The third solution is to turn the disk drive off and then on right before a save-with-replace. And be sure to include a zero (*SAVE "@0:programname",8*). Another way to reset the disk drive is to enter these two lines (they should be on separate lines, don't put them on a single line with a colon between them):*

```
OPEN 15,8,15,"UJ0"
CLOSE 15
```

Seeking Status

Where is the status register located? I don't mean the I/O status register.

John McNamara

It's deep inside the chip that runs your computer; it does not have a memory location you can PEEK, although after a machine language program exits to BASIC, you can find the most recent value of the processor status register (P) by PEEKing 783. Individual bits of P correspond to the carry, zero, interrupt, decimal, break, overflow, and negative flags. So, if you clear the carry flag with CLC, then add two numbers to get a result that's more than 256, the carry flag (one of the bits in P) will be set afterwards, indicating a number that won't fit into eight bits (in decimal, for example, 9 + 1 = 0, with a carry of 1). Most machine language instructions directly affect the A, X, and Y registers, and many will also set or clear individual flags in P.

It's sometimes necessary to preserve the processor status during a subroutine or interrupt, so there are instructions to push it on the stack (PHP) and pull it off the stack (PLP). If you'd like to read the status register, use PHP followed by PLA (push P on the stack, and pull the number back into the Accumulator).

Opening Multiple Files

We're trying to write a farm management program for our sow herd. In order to run the program efficiently, we have to be able to have two files open at once. After a lot of research, we still don't know how to do this. Can you help?

Delle deSwart

Theoretically, up to ten different files can be open at the same time. But there are certain rules to follow, and there are limits.

With the exception of relative disk files, once a file is open, you can read or write, but not both. In addition, certain devices have one-way communication—you can only read from the keyboard, and you can only write to a printer. If you owned two cassette drives, you could read from one and write to the other (Commodore PETs had this capability), but there's only one cassette port on the VIC, 64, Plus/4, and 16. So you can only talk (read or write, but not both) to one cassette file at a time.

You can communicate with more than one disk file, though, as long as you open them with different logical file numbers and different channels. So you could **OPEN 3,8,5, "0:FIRSTFILE,S,R"** *and* **OPEN 5,8,9, "0:OTHERFILE,S,W"** *to read (INPUT#3 or GET#3) from file 3 on disk channel 5 and write (PRINT#5) to file 5 on channel 9.*

It's also possible to use more than one disk drive, as long as they have different device numbers. The same applies to printers (the MPS-803, for example, has a switch on the back for choosing device number 4 or 5).

Relative disk files are a special case. You cannot have more than one relative file open at any one time (although you can open other types of disk channels).

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And, once a relative file is open, you can read and write to it.

Checking A Disk For Free Blocks

How do you find out how many blocks are left on a disk? Is there a program to access the disk drive (maybe PEEKs or POKEs) and then print the number?

David Ross

Here's a short routine you can add to your program. First, it opens a file to the part of the directory ($) containing all USR files named "Z." Because there are probably no such files on your disk, the subdirectory will be empty, containing only the header (disk name) and the number of blocks free. (Incidentally, the program won't work if you do have a USR file named "Z.") Next, the first 34 bytes are thrown away, which leaves the answer in low-byte/high-byte format. In line 50, the number of blocks free (variable BF) is printed.

```
10 OPEN1,8,0,"$0:Z=U"
20 FORJ=1TO35:GET#1,X$:NEXT
30 GET#1,Y$:CLOSE1
40 BF=ASC(X$+CHR$(0))+256*ASC(
   Y$+CHR$(0))
50 PRINT BF"BLOCKS FREE"
```

Animating Sprites

How can you make a sprite that has moving parts—a sprite person that walks along with legs that move, for example?

Geoff Hill

Once you've defined a sprite shape, and POKEd the information into memory, you have to tell the computer where in memory it can find the shape. The sprite shape pointers are located at 2040–2047 (corresponding to sprites 0–7). The number in 2040, times 64, is the beginning of the shape for sprite 0, for example.

To create an animated sprite, you'll have to design two or more shapes for that single sprite. A walking sprite might need four shapes: 1) feet together on the ground, 2) one foot forward in the air, 3) feet apart, both on the ground, and 4) one foot behind, in the air.

You could put these four shapes into 16128, 16192, 16256, and 16320 (each sprite shape needs 63 bytes). These numbers divided by 64 are 252, 253, 254, and 255. To give sprite 0 the first shape, **POKE 2040,252**. *To give it the last shape,* **POKE 2040,255**. *With a single POKE to the sprite pointer, the whole shape of the sprite changes. Cycling through the different shapes would make it look like the sprite is walking in place. If you then gradually increase the X-coordinate, it would seem to be walking across the screen.*

Can You Rearrange A Directory?

I would like to change the order of program and filenames in some of my disk directories. Is this possible? Or will I have to copy the files onto a new disk in the desired order?

David Voelker

If you scratch a program from disk and then save a different program, the new program shows up in the same place in the directory as the program that was scratched. So you could load a program, save it under a different name (to the same disk), and then scratch the original. The next program or file would go into the empty slot.

But there's a simpler way—the COPY command, which makes an exact copy of a file on the same disk, under a different name. The syntax is **OPEN15,8,15: PRINT#15, "C0:newname=0: oldname": CLOSE15**. *Let's say you have a sequential file and a program on a disk in this order:*

```
10 "FILE1"      SEQ
23 "PROGRAM1"   PRG
```

To switch the order, enter the following commands in immediate mode:

```
OPEN15,8,15
PRINT#15,"C0:TEMPFILE=0:FILE1"
PRINT#15,"S0:FILE1"
PRINT#15,"C0:TEMPPRG=0:PROGRAM1"
PRINT#15,"S0:PROGRAM1"
PRINT#15,"R0:PROGRAM1=0:TEMPPRG"
PRINT#15,"C0:FILE1=0:TEMPFILE"
PRINT#15,"S0:TEMPFILE"
CLOSE15
```

First, FILE1 is copied (C0:) to a file called TEMPFILE (in the third spot on the disk). The directory now contains FILE1, PROGRAM1, and TEMPFILE, in that order. Scratching FILE1 (S0:) leaves a space open at the beginning. Next, PROGRAM1 is copied to TEMPPRG (which is now in the first slot). After the second copy, the directory should look like this:

```
23    "TEMPPRG"     PRG
23    "PROGRAM1"    PRG
10    "TEMPFILE"    SEQ
```

Now, PROGRAM1 is scratched (leaving the second slot open), TEMPPRG is renamed (R0:) to PROGRAM1 and TEMPFILE is copied to FILE1. Finally, TEMPFILE is scratched.

Converting A Number To ASCII

How do I convert a number to ASCII codes that can be printed? If I have a byte containing a 65 and try to print it, won't it appear as an "A"? How can I make a 65 into the characters "6" and "5"?

Lonnie De Cloedt

As you've noted, LDA #$41:JSR $FFD2: RTS will put an "A" on the screen. The ASCII values for "6" and "5" are 54 and 53 (hex $36 and $35). So the routine you need will have to PEEK a byte and translate it to one or more ASCII numbers.

Since the number may be anything from 000 to 255, you'll need to set aside three memory locations. First, put 48s (hex $30) into the three locations because the character "0" is ASCII 48. Load the Accumulator with the number to be translated, and compare it with 100 (CMP #$64). If the carry is set, the number is higher than 99, so you can subtract 100 (SEC:SBC #$64) and increment the first of the three memory locations (representing the hundreds column). Keep comparing the number to 100 and subtracting 100 as long as the carry is set. When the carry is clear, the number will be in the range 0–99. Then do the same for the tens column: compare to ten (CMP #$0A) and if the carry is set, subtract ten and increment the tens column. When you've gotten to a number less than 10, you can just add it to the third memory location. Now print the three ASCII numbers you've generated.

Not surprisingly, there's a ROM routine that translates numbers to their ASCII equivalents and prints them. To call it, load the Accumulator with the low byte, load the X register with the high byte, and JSR $BDCD on a 64 ($DDCD on a VIC). The number will print wherever the cursor happens to be.

Peculiar Vectors: A 6502 Bug

Machine language programmers should exercise caution when using an indirect jump on the 64.

If the indirect vector crosses a page boundary, JMP ($10FF) for example, the low byte of the address will go into one page ($10FF) and the high byte into the beginning of the next page ($1100). The JMP instruction, however, will take the low byte from $10FF, and the high byte from $1000 *and not $1100, as it should.*

In the three books I've read on the 6502, I have never seen this mentioned, and I thought your readers would appreciate this information.

Kernie E. Houser

This bug in the 6502 and 6510 chip affects not only the 64, but the VIC, Atari, Apple II, and any other computer built around that family of chips.

Because of this quirk of the 6502, you should either avoid indirect jumps altogether or put your vectors in a place that you know is definitely not a page boundary.

For readers who aren't familiar with indirect jumps, here's a brief explanation. An absolute jump is like GOTO in BASIC. JMP $C200 sends a machine language program to whatever ML program is currently at $C200. An indirect jump, signalled by an address in parentheses, does something different. The instruction JMP ($0330) does not jump to a program at $0330, it gets an address from $0330–0331 and jumps to that address. So $0330 is a vector or pointer to another routine, and an indirect jump bounces off the pointer to somewhere else in memory.

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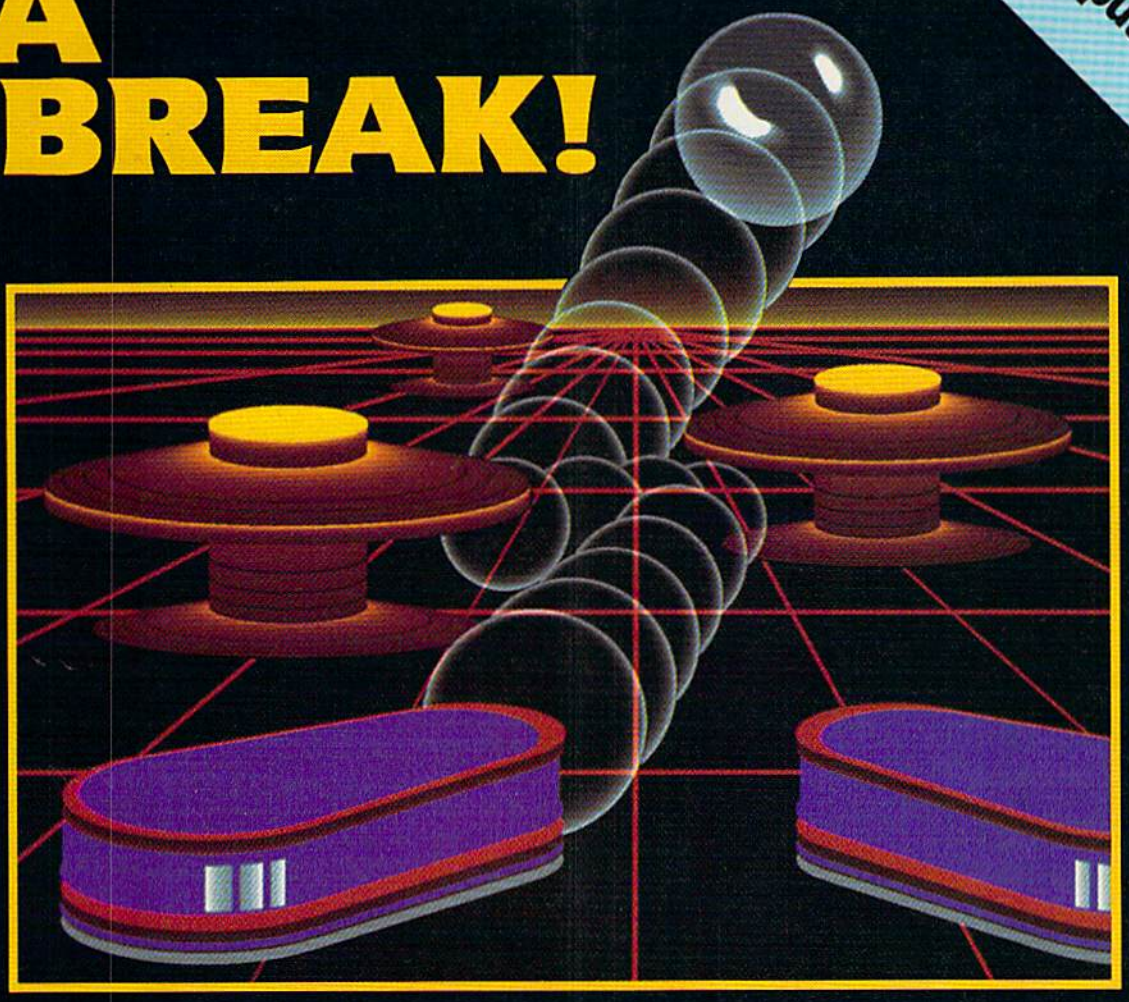

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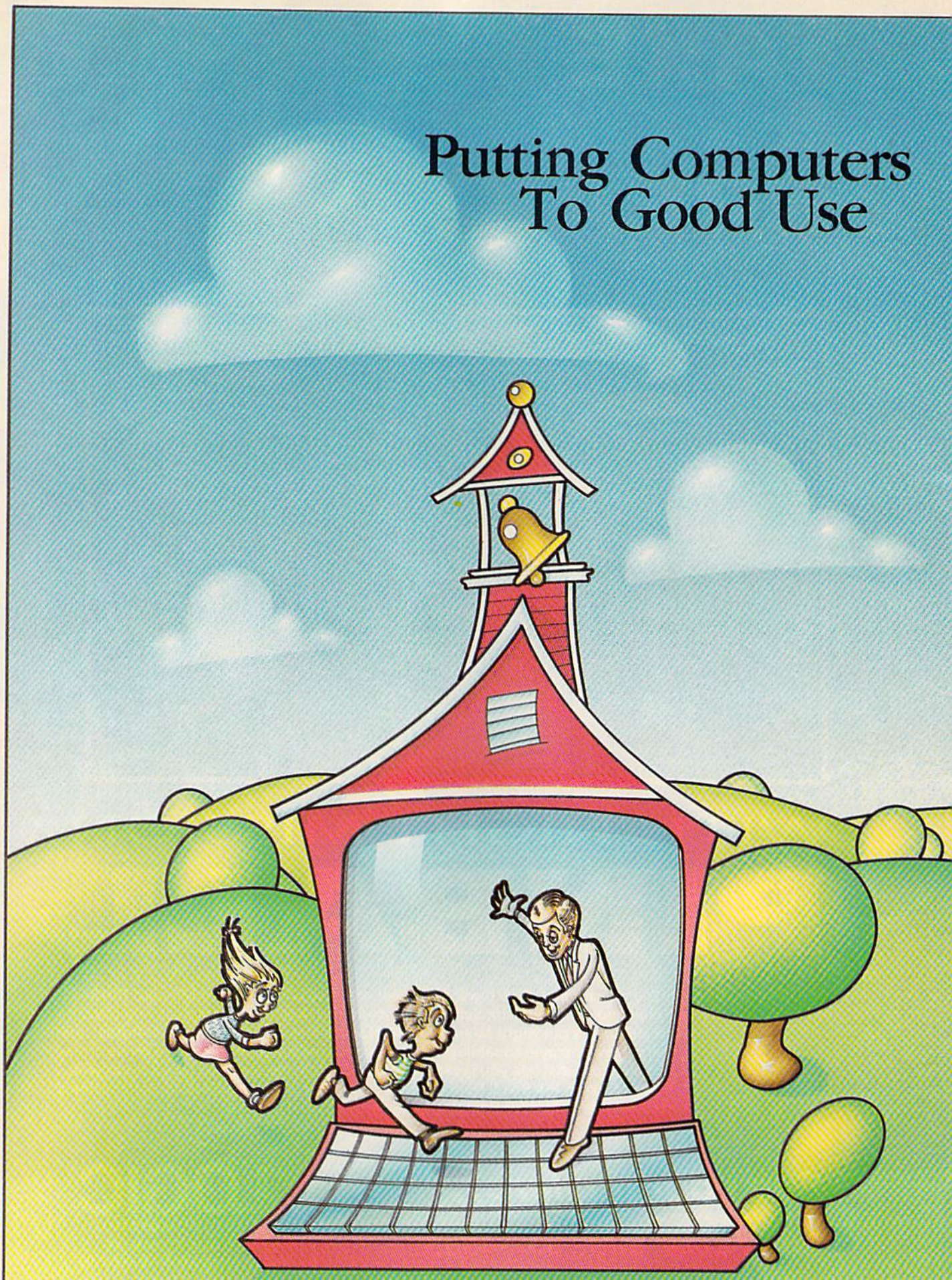

The Innovative School

Selby Bateman, Features Editor

Computer use in the classroom is entering a second stage of development. The frustrations experienced by some school systems are dwindling as more educators learn new ways to integrate the machines into the learning process. A growing number of interested, more experienced administrators, teachers, and parents are proving that computers in the schools can be productive, dynamic tools when used properly.

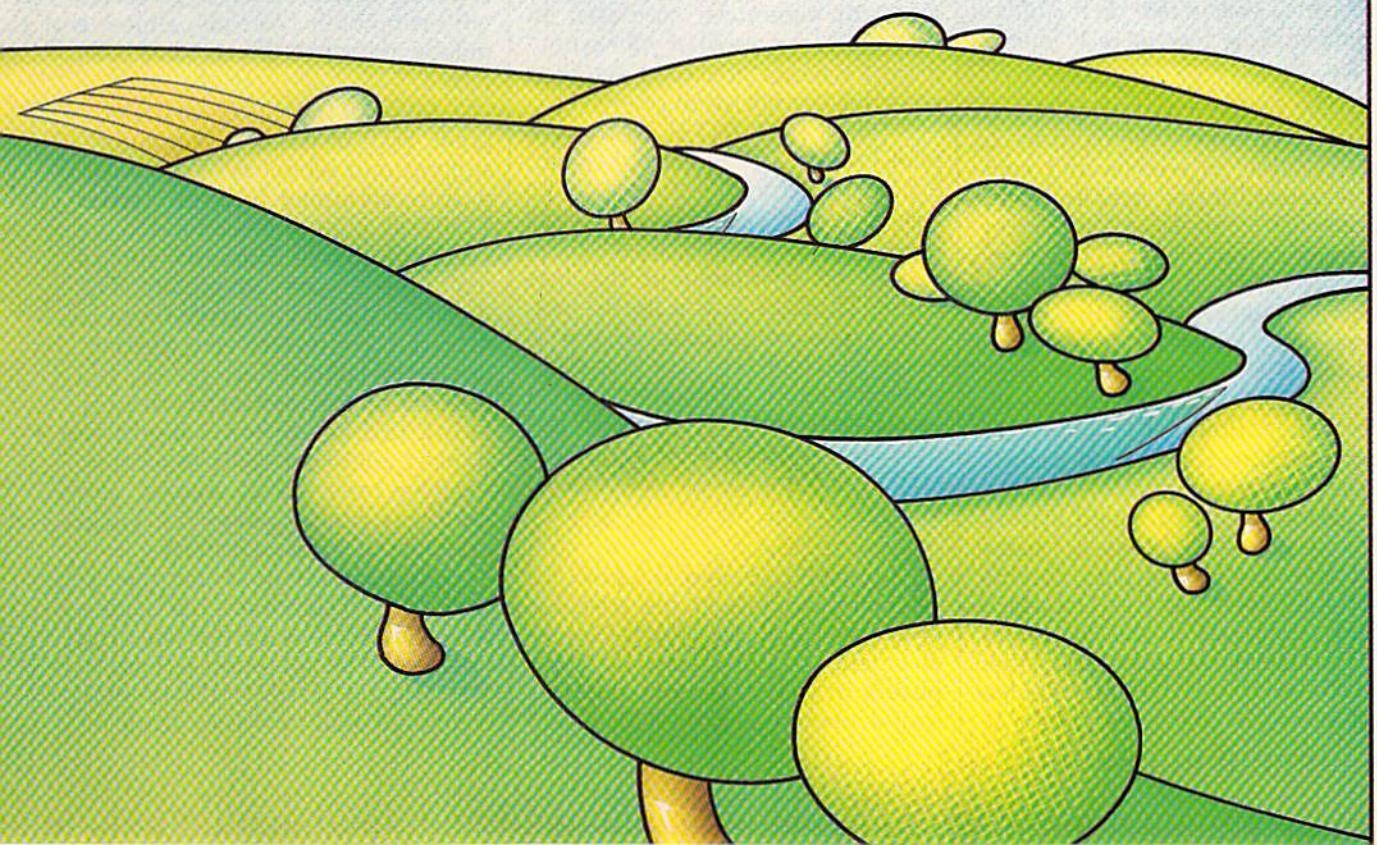

Illustration by Lee Noel

Dr. Mary Lou Simon listened to the school superintendent's voice at the other end of the telephone line. The words were familiar:

I just put 20 computers in two elementary schools, he said. And I want to send a couple of my principals to see how you use computers in your school system.

Why did you buy them? Dr. Simon asked.

The superintendent paused, then said: I want computers in our schools.

But what do you want to do with them? Dr. Simon asked.

Another pause. Well, said the superintendent, I promised parents in our school system that their children would be using computers 20 minutes a day.

Dr. Simon has had plenty of those telephone conversations in her position as science and computer coordinator for the South Brunswick Schools in New Jersey. She knows that many well-meaning educators and administrators in school systems across the nation have been *trying* to do the right things with computers; eagerly launching their new machines only to see them flounder for lack of direction, trained staff, and realistic goals.

Along with other educators, Dr. Simon has witnessed frustration among some teachers, parents, and students as schools attempt to bring computers to the classroom. The problems, say these educators, are almost always the same: too few computers, or machines poorly allocated; software inappropriate to particular courses; teachers not given the chance to learn to use the machines; and planning based on too little computer knowledge.

But these complaints are slowly changing as experience grows and educators are better able to incorporate computers into the curriculum.

"People have just been interested in throwing in the hardware with no sense educationally of what they want to do," says Dr. Simon. "In getting your goals straight, it's critical that you spend a fair amount of time finding out what computers can do. Based on that and based on what your school district's needs are, then set your goals for the microcomputers."

"The first DO is to have a plan," adds Dr. Stanton Leggett, editor of *Microcomputers Go to School: Where and How to Get the Most from Them* (Teach'em, Inc.). "Don't be enamored of the machine. Think of it as a useful tool. The whole educational system is what you look at; how the computer fits into it. What are the most likely areas where you can get immediate gratification for a minimal amount of money—a cost benefit analysis."

The most common situation for many schools in the past has often been a classic Catch-22 predicament: To effectively use computers in the classroom requires sound planning; to initiate sound planning requires a familiarity with computers.

"What I've found is that schools sometimes need to have a few computers around for a while in order to make a good choice," says Dr. Steve Tipps, West Professor of Education at Midwestern State University in Texas and a leader in training teachers in the Logo computer language.

In other words, administrators and teachers can't be expected to make a plan unless they have some context in which to make choices. Now that many teachers and administrators have been working with computers—at least minimally—for a couple of years, an increasing number of them better understand what the machines can do. Consequently, planning and goal-setting have begun to improve in many schools using computers as a part of the teaching process.

In Kentucky's Jefferson County Public Schools, for example, a long-range computer acquisition program was recently instituted when educators, parents, and business leaders coordinated their efforts. Based on their experience with computers already being used in all of the high schools and some middle schools, community leaders in 1984 embarked on a three-year plan to raise more than four million dollars to equip all 85 elementary schools in the Louisville system with computers. Already, almost a million and a half dollars have been raised.

Much of the success of the program, both in terms of community support and school system coordination, stemmed from an earlier $150,000 pilot project funded by Louisville-based Humana, Inc., a major health-care corporation. The donation allowed the school system to equip Roosevelt-Perry Elementary School with 75 computers. The benefits of that project are already being felt as students begin to transfer computer skills to writing, language arts, social studies, and math instruction, says Jay Beck, principal of Roosevelt-Perry.

Beck is convinced that the introduction of computers has made a major difference in the learning process: "The computer is here to stay. It is not a fad. Understanding computers and how they work for

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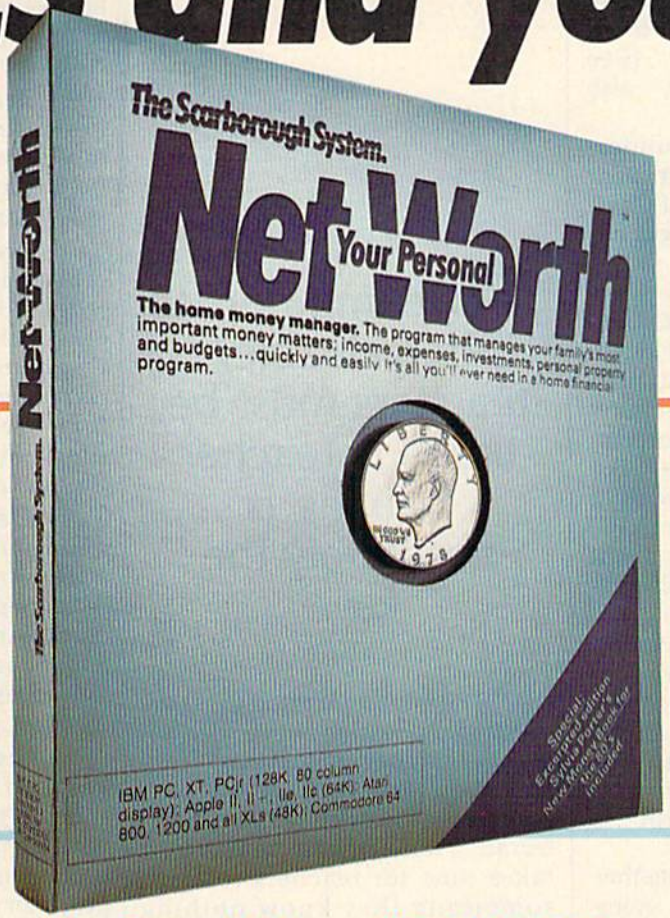
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us is basic. We need to teach our students the new communication skills. We must augment the three Rs with the three Cs—computing, calculating, and communicating through technology. Students must possess technological literacy. The answer is the computer."

Another area of common concern as computers increasingly enter the classroom has been how well teachers are able to understand and use the machines.

"For computers to be valuable, teachers must be trained," says Pat Walkington, formerly a teacher for ten years and now manager of education marketing for Commodore Business Machines. "Teacher training is absolutely the key." (See "Commodore in Education," also in this issue.)

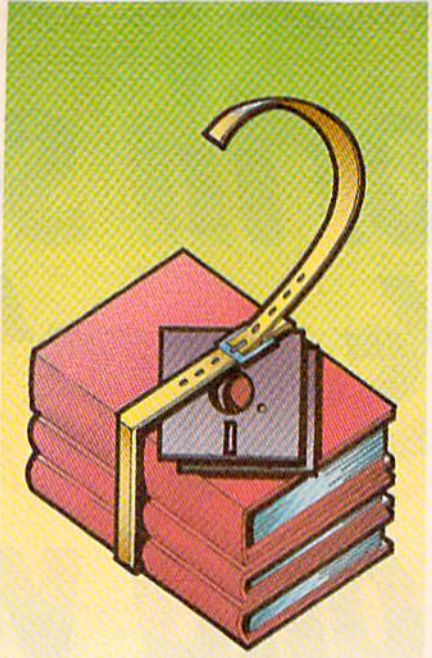
Assisting teachers to understand and get the most from their computers is a cornerstone of Commodore's efforts in the schools nationally, says Walkington.

"The burden of change is on the teacher," agrees Leggett, "and the teacher is already overloaded. The teacher can't stop and drop everything and pick up a computer to learn how to use it. We're expecting too much from teachers." But he's convinced that, with the right approach, teachers not only can become more knowledgeable about computer use, but they can also become enthusiastic about it.

At its worst, says Midwestern State's Steve Tipps, a teacher's introduction to computers in education has in the past been the arrival of a boxful of computer equipment—no instruction and no predetermined goals. That, too, is changing.

"Teachers have to get together and ask what goals they're going toward with the computers," he says. "Are we going toward the computer as a problem-solving tool, an applications tool, an instructional system, computer-aided instruction?"

Teacher support groups, much like computer user groups, have begun to spring up in various locales, notes Tipps. The Texas Educational Association has even established a telecommunications network, but teacher use of modems is still quite limited.



"For computers to be valuable, teachers must be trained. Teacher training is absolutely the key."

"The important thing to realize is that many teachers have been out of college a good many years," says Mary Lou Simon. "Computers are brand new. We might as well be integrating Russian into the school. It takes time for teachers to learn something they know nothing about. The mistake that a lot of districts make is they think they can give their teachers a day of training and they'll come back and be experts."

In Jefferson County, Colorado, the school system has adopted an effective approach through its central office, says Tipps. A computer support group—composed of four teachers on leave from the classroom—work with other teachers to carry out in-service computer training, curriculum development, and related support of computer activities. The results, in terms of morale and productivity, have been impressive.

How can educators, parents, and students help to make sure that computers are used effectively in the classroom? Based on interviews with innovative educators and computer education specialists, here's a checklist of DO's and DON'T's for your school system:

- **Start with specific goals, followed by step-by-step planning:** Set realistic goals before you begin acquiring hardware and software, and certainly before asking teachers to incorporate the machines into daily use.
- **Teacher training:** Hands-on in-service training for teachers is a must; teacher support groups also help teachers dealing with similar subject areas to find out what to do.
- **Access/scheduling:** This is a challenging management problem when too many students and teachers are chasing too few computers. Computer literacy classes—no; computers in the regular curriculum—yes. Computers should be supplementing and complementing the curriculum, not disrupting it.
- **Developing support:** From raising funds for hardware and software to raising the computer consciousness among parents, this is a crucial area for most schools now and in the future. Parents can be involved as well as community and business groups.
- **The computer is a tool, not a second teacher:** "Teachers shouldn't be regarding software as the functional equivalent of a reel of 16 mm film that you put on a projector and show to students who just sit there and absorb education," argues Mark Tucker, executive director of the Carnegie Forum on Education and the Economy.
- **Dispelling the computer-math myth:** Educators and parents must realize that computers and mathematics are not one and the same thing. "Teachers have been delighted to find out that they don't have to be mathematicians to get the computer to do wonderful things like word processing," says Tipps.

Commodore In Education

As school systems across the continent race to stay abreast of the educational computing wave, many of them are finding the Education Department at Commodore Computer Systems Division to be both a knowledgeable coach and a well-connected booster.

Consider the following:

• **Donations**—Through its CREWS (Commodore Resources in Education With States) program, Commodore has donated well over a thousand computer systems to more than 25 states. The project encourages state departments of education to promote teacher training and curriculum development for microcomputer use.

• **Matching Grants**—Commodore provides matching grants to schools for the purchase of computer systems. More than a million dollars in grants have been awarded, with over 100 grants so far this year.

• **Young Astronaut Program**—As the first of 14 national sponsors of this space exploration program for youngsters, Commodore is the official supplier for all microcomputer products. Dr. Dan Kunz, Commodore's executive director of government marketing, is on extended leave to direct the program's activities.

• **Telecommunications**—Commodore's efforts in the educational field will increasingly include the growing area of telecommunications, with several initiatives still in the planning stages for late 1985 and 1986.

• **A Presidential Classroom for Young Americans**—Commodore is a primary sponsor for this annual week-in-Washington series of seminars, lectures, and meetings for selected high school juniors and seniors.

• **Olympics of the Mind**—More than 150,000 students from 4,500 school districts in the United States and Canada took part during 1985 in this creative problem-solving competition cosponsored by Commodore.

The emphasis in all of these efforts is on teacher training, school program incentives, and student hands-on involvement, says Pat Walkington, director of Commodore's educational marketing division.

"We think that schools ought to do their own (teacher) training because each system is unique," she says. "We feel they have the resources for training, and what they need from us is equipment."

But, she adds, Commodore's efforts are aimed at more than simply putting machines in front of teachers and students. That's been the premise behind making the donation, matching grant, and related programs work on an incentive basis. School systems make written proposals for innovative uses of computers, and Commodore tries to work with those schools in a variety of ways.

In Texas, for example, where a recent mandate urges all junior high school teachers to become computer literate, Commodore has donated 60 computer systems, including monitors and disk drives. All five boroughs in New York City have benefited in some way from Commodore's school programs, including almost 2,000 teachers in the Bronx who have been involved in computer training.

The matching grants program reflects a similarly wide range of support. In Brooklyn, New York, a Commodore matching grant helped School District 18 begin using the Logo computer language as an art medium. Another grant is aiding the University of Houston's College of Optometry to develop simulation software for the teaching of clinical practices in optometrics. And yet a third matching grant to the Hillhouse Computer Association in Pittsburgh helped start an inner-city after-school computer club for students as well as evening computer classes for adults.

Commodore's education staff members, most of whom were teachers or educational administrators, feel that the low price of Commodore computers in addition to the wealth of available software is responsible for recent upsurges of interest in Commodore among school systems. And with the national student-computer ratio still at approximately 97:1, Walkington is convinced that the biggest growth is yet to come.

One example of the growing momentum in educational computing is The Young Astronaut Program, notes Kunz. Conceived by nationally syndicated columnist Jack Anderson and kicked off in 1984 by President Ronald Reagan, this program tries to involve students in grades one through nine in activities related to space exploration under the direction of the Young Astronaut Council.

Council chapters composed of from 5 to 30 students can be formed through schools or, in some cases, independent of schools. The cost is $20 annually per chapter, with the bulk of the costs being picked up by corporations and other businesses. Included are activity packages, such as model rocket building kits; AstroNet, a telecommunications service for use among chapters; and educational materials to supplement school curriculums.

"The key here is the flexibility of the program, and the fact that it's a supplement to the curriculum," says Kunz. "Teachers can use it in association with any part of the curriculum."

Beginning September 14, CBS will begin airing a weekly Saturday morning animated educational program for children entitled *The Young Astronauts*, Kunz adds. All of the material used in the series will be educationally and scientifically accurate.

Commodore is eager for school systems, teachers, parents, and students to take advantage of the many programs under way. The following addresses and telephone numbers should help you get started:

Commodore Business Machines, Inc.
Education Dept.
1200 Wilson Dr.
West Chester, PA 19380
(215) 431-9100
Commodore Toll-Free Hotline:
1-800-247-9000

Young Astronaut Council
P.O. Box 65432
Washington, D.C. 20036

Olympics of the Mind
OM Association, Inc.
Dr. Samuel Micklus
P.O. Box 27
Glassboro State College
Glassboro, NJ 08028
(609) 881-1603

A Presidential Classroom For Young Americans
441 N. Lee St.
Alexandria, VA 22314

• **Appropriate software:** Programs which can be integrated into the classroom with the current curriculum should be a central goal.

The appropriateness of different types of computer software for education remains one of the most hotly debated topics in the field today.

"Most of the software that we need already exists and it's in the form of what the rest of the world calls *productivity software,*" says Carnegie Forum's Tucker. "Special databases, word processing programs, spreadsheets." The trick, he adds, is to adapt the programs to particular subjects while at the same time deciding how and when to adapt classes to take advantage of the new materials.

"We don't teach much writing to elementary school children. We don't even start teaching writing before junior high school," he adds. "But it's fairly clear now from the point of what's happening with word processors that we can teach writing in the elementary schools."

Sophisticated science software is already available to let students simulate laboratory instruments, Tucker notes. Not only can traditional science instruction be carried out with this software, but even more complex comparative work can be simulated with a wide range of variables. "You cultivate a real intuitive sense about how these variables are related, not just memorizing the stuff that's in the textbook," he says.

It is this conception of the computer as tool rather than instructional device which Tucker and others promote as the most effective way to use computers in the classroom. "Whether you're using ready-made applications software, making your own program, or something in-between, you're still using the computer as a tool to get some tasks done. The computer is not a *course*, it's a *tool*."

Related to this idea is the fact that computer-aided instruction is currently based around short 15–20 minute programs which are difficult to integrate into a school's standard curriculum format, says Dr. Larry Fedewa, executive director of the National Education Association's (NEA) Educational Computer Services.

"From this derive all sorts of problems—scheduling, equipment access," he says. "So, what's coming in the future is curricula on a network system."

As an aid to teachers and parents who want more information on the kinds of educational software available, the NEA publishes *The Yellow Book: A Parent's Guide to Teacher-Tested Educational Software* (Garland Publishing, Inc.).

Whatever the specific software instruction, Leggett cautions educators to remember that the fundamental goal is to help teach students how to think. "So this becomes a goal—to say that what we're working toward is teaching thinking, teaching sophisticated reasoning. Otherwise," he concludes, "it's not worth doing."

Commodore's Pat Walkington sees three important factors relating to the evolution of this educational software. First, much of the initial "home-school" software available didn't work out, she notes, largely because parents didn't have any better idea than their children what to buy.

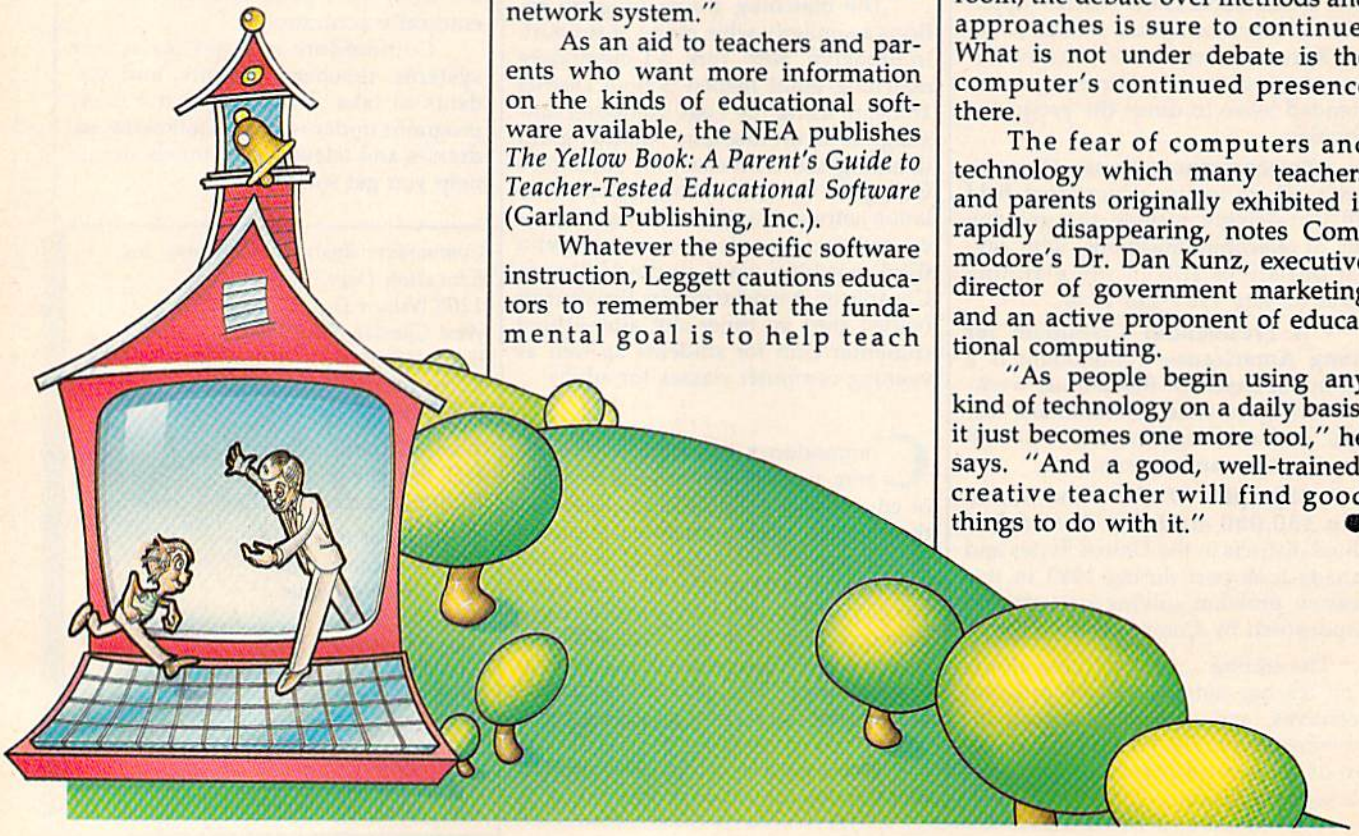
Second, the "tool" software programs mentioned by Tucker—word processors, spreadsheets, and databases, for example—are beginning to appear in a few schools as real-world teaching tools, she says. However, the number of teachers now using them is small.

And third, Walkington points out that traditional textbook publishers—who know curriculum content—are beginning to produce course materials as textbook-software combinations, a trend which is bound to increase the presence of computers in schools.

As educators continue to find these and other ways to incorporate the computer into the classroom, the debate over methods and approaches is sure to continue. What is not under debate is the computer's continued presence there.

The fear of computers and technology which many teachers and parents originally exhibited is rapidly disappearing, notes Commodore's Dr. Dan Kunz, executive director of government marketing and an active proponent of educational computing.

"As people begin using any kind of technology on a daily basis, it just becomes one more tool," he says. "And a good, well-trained, creative teacher will find good things to do with it." ●



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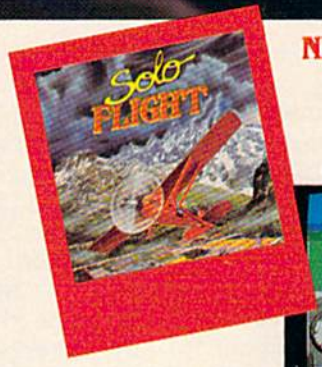

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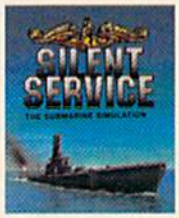

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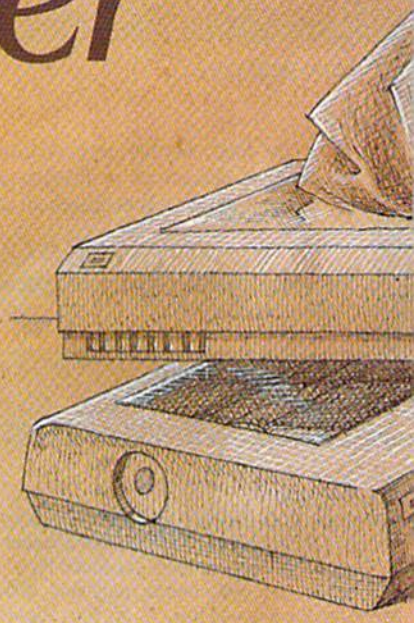
Picking The Right Printer

Charles Brannon, Program Editor



If you're considering buying a printer or don't really understand the one you have, this article can eliminate some of the confusion. It explains current printer technologies, what they offer, and discusses the basic considerations involved in choosing the right one.

Computers are supposed to eliminate paperwork, but it's a fact that paper is still the universal medium of communication. Perhaps when everyone has a computer or terminal, paper will no longer be necessary.

There's little disagreement, however, that a printer is an exceptionally valuable addition to any computer. But if you decide to buy one, you'll face a plethora of choices. There's a dazzling array of printing technologies, interfaces, paper requirements, DIP switches, ESCape codes, ribbons, and character sets. And getting your printer to work with your software can be tricky at first.

There's an answer to the confusion. It's important to be informed before you buy your printer, but equally important to know how to use it when you bring it home. Get to know the features of printers in general, form a solid idea of what you need in a printer, then consider what options you can afford.

All printing technologies have one thing in common—they use energy (force, heat, or even laser beams) to change the color of the paper.

Impact printers forcibly strike a section of ribbon against the paper, transferring a bit of ink. Inked cloth ribbons are reusable. The entire length of the ribbon can usually be recycled several times, and even re-inked indefinitely. Carbon film ribbons are not reusable. The thin black coating is removed from the plastic ribbon, leaving a blank hole behind. If that portion of ribbon comes back around, printing will be spotty and uneven. The additional cost of these ribbons is offset by their high-quality solid impression.

Impact printing includes both dot-matrix and letter-quality printers. Most "letter quality" printers use a wheel or ball of formed characters. The actual shape of the character is rotated into position and slammed into the ribbon. Most typewriters rely on this method. A few printers (mostly teletype machines) use the IBM hemisphere "ball." The entire ball is twisted and tilted to bring the proper character to the front, then knocked

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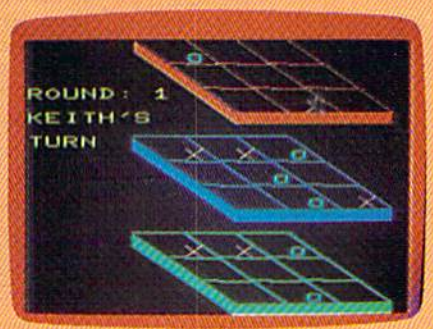

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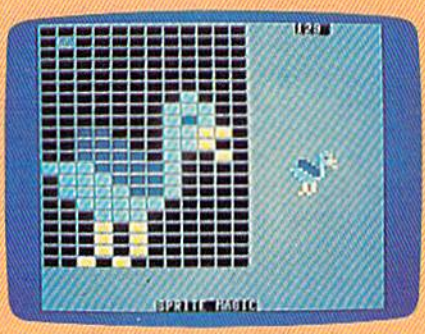

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like a rapper against the ribbon and paper. The ball was never designed for any speed beyond normal typing rate, so using a Selectric as a printer can rack up some massive service bills (not to mention warranty conflicts).

A superior technique uses a central wheel with radiating spokes, each tipped with a complete character. Superficially reminiscent of a flower, these printing wheels are known as *daisywheels*. Often a printer using a daisywheel is also called a daisywheel, or simply "daisy." The wheel is spun so that the desired letter is in position, then a small solenoid (an electromagnetic hammer) stamps the tip against the paper. Another formed-character variation is the band printer, which uses something like a high-speed chain. The chain has all the characters arranged serially. As the chain whizzes past, the printer waits for the desired letter to come by, then strikes it against the ribbon and paper.

The formed character printers create beautifully sculptured print, but can be inefficient. Your repertoire of characters is limited to those actually present on the wheel or ball (although you can switch character sets just by replacing the ball or wheel). You can't reproduce graphics (though some daisywheel printers let you "draw" with periods). The printer has to spin each character into place, which takes some time and quite a bit of coordination. Many daisywheel printers use slow stepper motors (which advance one click at a time), or light-beam links to synchronize the printer's timing with the actual speed of the wheel. It's a complicated contraption. And all that slamming, stamping, striking, and rapping is hard on the printwheel (not to mention quite noisy). Metal printwheels are expensive, and plastic ones wear out quickly. At least for now, though, the print quality of daisywheels is hard to beat.

A far more flexible way to produce characters is to create them a dot at a time. Text is printed within a matrix of tiny squares or dots. A similar technique is used to display characters on your display screen, or on marquees. Many dot-matrix printers produce text that looks "computery," although some have such a tight matrix that it's hard to detect the dots without magnification. Some printers can go back for a second pass to fill in the line by shifting over one half-dot, or by moving the paper up a fraction of an inch, before overstriking.

Most dot-matrix printers print by sweeping a thin column of pins or wires across the paper. Impact dot-matrix printers fire tiny solenoids against these pins to strike them against the ribbon. The sound of these pins beating across the paper is loud and screeching, though recent advances in printheads and soundproofing have reduced this to a bearable level.

But impact isn't the only way to put an image on paper. Why not build the ink into the paper itself? A thermal printer uses a column of "hot spots." The heat-sensitive paper darkens when touched by the hot thermal pads. Since there's no impact, thermal printing is very quiet. The printing assembly is quite simple, so thermal printers are relatively inexpensive. An interesting feature of thermal paper is that it also tends to change color in your glove compartment on a hot summer day.

Electrostatic printers use a column of minute "spark plugs." As the column sweeps across the paper, these little shockers emit tiny sparks that evaporate a silvery coating, revealing an underlying black surface. Reading black on silver is difficult, but the paper photocopies well, giving it a more conventional appearance.

It seems printer manufacturers will try anything. Inkjet printers spray liquid or powdered ink through tiny jets. Again, these jets are arranged in a column, and sweep across as they spray. Ink-jet printers are fast and quiet, yet can print on any paper. But because the technology is still a bit new, these printers cost more than comparable dot-matrix or thermal printers.

A promising new technology is a variation of thermal printing. Instead of heating up unusual paper, or smacking against it, thermal-transfer printers heat up a waxlike ink. The paper, the ink, and the printhead are sandwiched together. The ink melts and fuses with the paper—at least in theory. Many thermal-transfer printers require close contact between ribbon, paper, and printhead. Unfortunately, these printers darken only the raised surface of the paper, so nubby paper (like bond) shows a venetian-blinds effect, or worse, looks like it was printed by a worn-out printhead with a used-up ribbon. Like carbon film ribbons, thermal-transfer ribbons are not reusable. So although these printers promise to have the quiet manner of thermal printing while not requiring special paper, most thermal-transfer printers do require especially smooth paper. New advances in thermal-transfer have solved these problems, but at a higher price.

Laser printers have finally arrived. Although they're expensive ($3000–$5000), nothing can match the quality. In fact, laser printers can produce typeset-quality text, like you're reading now. Laser printers use the "engine" from a photocopy machine. A statically charged drum attracts dry ink dust, except when the charge is removed by intense light. The drum rolls the powdered ink impression onto paper. In a photocopy machine, the image of the paper is focused onto the drum. In a laser printer, a scanning laser writes directly onto the drum, permitting almost any image to be drawn. The laser printers work as fast as a copy machine, spitting out a complete page in seconds.

Your computer is a colorful creature, but printing has always been in boring shades of black. Some printers can accept different colors of ribbon, but can't print in more than one color. However, there are several ways to achieve true color printing. Most work by mixing several primary colors. For example, red plus yellow equals orange; red plus blue equals purple. A few years back, a product appeared which added color capability to any printer. It consisted of a supply of red, blue, and yellow carbon paper, plus some graphics printing software. You taped the red carbon pa-

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per to a blank piece of paper, inserted the whole thing in the printer, then printed the portion of the text or graphics that contained red. You next removed the red carbon, substituted the blue, and overprinted the sections that required blue. You finished it up with the yellow carbon. If you'd properly aligned the paper each time, you'd get a multicolor image.

Most color printers these days use multicolored ribbons. The ribbon can be made up of a series of yellow, red, and blue strips, each strip the width of the paper. One whole segment of ribbon is used for each line, with three segments necessary to print one line. Even if a certain color isn't used, that segment must still be skipped over so that the next line starts with the right color. This uses up ribbon fast. Another trick is to stack several colors vertically. The ribbon is installed at an angle so that the printhead can print across all the primary colors, creating multiple colors on the same line in a single pass. Rather than using a ribbon installed at an angle, another color printer just shifts the ribbon up and down to get to the right color, but it can't print more than one color in one pass; it must go back and overstrike. In any case, you'll need custom software to take advantage of the color capability. Some color printers may include the necessary color graphics program.

You should also consider the type of paper you'll be printing on. The least expensive printers use a friction feed mechanism to drive the paper through, using a roller (platen) much like a typewriter's. Friction feed can transport almost any paper, including cut-sheet (letterhead) and inexpensive roll paper, but is prone to misalignment. All it takes is a few paper slippages to give you skewed printing, especially at high speed.

To circumvent this problem, the computer industry developed a special kind of paper, called pinfeed, tractor, or fanfold paper. This paper is bound on both sides with a strip of punched holes. Each sheet is attached to the next with a serration. This lets a toothed cog grab the edges of the paper and roll it through continuously. The perforated strips can usually be pulled off and each sheet detached to transform each page into normal letter-size paper. If you don't want anyone to know it was printed with a computer, you can buy special paper that allows you to tear off the strips and separate the sheets cleanly with barely visible rough edges.

Your printer must have a tractor-feed mechanism to use this paper, unless the friction-feed carriage is wide enough to accommodate the extra width of pinfeed paper. Many printers have both friction- and tractor-feed. With tractor-feed, you needn't worry about paper slippage, although some tractor-feeds that push the paper through the carriage from behind can bunch up the paper. If the paper supply does not flow smoothly, the paper can tear free from the tractor cogs. You must also be careful to prevent the ejected paper from rolling back into the carriage. Paper separators are included with most printers to help prevent this problem. If you need to print wide reports, you may want to look into a wide-carriage printer. Most 80-column printers have a condensed mode that gives 132 characters per line. Wide-carriage printers can print on 15-inch wide paper. In condensed mode, you can fit 255 characters on a line.

Whatever type of ribbon your printer needs, make sure it's easy to get replacement ribbons. A printer ribbon doesn't last as long as you may think it would, especially when printing reams of listings. Many printers use the widely available ribbon cartridge originally used with the Epson MX-80. Others can use ordinary typewriter ribbon spools. Some printers use ribbons only available from the manufacturer, at a premium price.

When shopping for a printer, always get a printed sample of the character set. Inexpensive dot-matrix printers can be fine for rough drafts and listings, but when you want to make a good impression (especially for business correspondence), you must have letter-quality, or at least the near letter-quality available on some dot-matrix printers. For word processing, you'll probably want to know what fonts and styles are available, such as double-width, condensed, boldface, italics, and especially underlining. Before you buy your word processor, make sure it can support your printer. And if you already have a word processor, check to see which printers it supports before buying. Some word processors will work with any printer, letting you embed printer codes for special fonts and typestyles. If you want to dump screen graphics onto paper, make sure the printer supports the graphics mode used by the screen-dump program.

How patient are you? The speed of a printer is important to many people. The higher-priced printers often can claim no more features than the lower-priced ones, but can print as much as twice as fast. Speed is usually measured in "throughput," not the actual speed of the printhead. Many printers print bidirectionally. Instead of wasting the time spent in returning the carriage, these printers can print from right to left on the return trip. Logic-seeking printers don't waste time printing a space, but skip the printhead to the next non-space position. And instead of feeding paper a line at a time, some printers can eject paper quickly to skip vertically or between pages. For dot-matrix printers, the rated speed is usually

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Mitey Mo opens up a world of practical and exciting uses for your C-64. It lets you send and receive electronic mail, link up with community bulletin boards, play computer games with people in distant places, tap into library resources, and much more. All at your convenience.

Until Mitey Mo, Commodore's 1650 Automodem was the obvious choice when you went looking for a modem for your computer. Like Mitey Mo, it has "auto answer"—it receives data while unattended. And both modems are "auto dialers"—you dial right on the computer's keyboard. But that's about where the similarity ends.

Mitey Mo can dial up to 9 numbers sequentially. But suppose you dial a number and find it's busy. Mitey Mo has "auto redial"—it hangs up and redials immediately until it gets through. With the other modem you have to redial each time—and somebody with auto redialing can slip in ahead of you.

Mitey Mo is menu driven. It lists the things you can do on the screen. Select a number and you're on your way. Since Automodem isn't menu driven, you'll be hunting through the manual a lot.

With Mitey Mo, your computer's function keys are programmable—you can save yourself plenty of keystrokes. Not so with the other modem. And only Mitey Mo lets you store data to review or print it later.

Mitey Mo has just one switch, the Smart 64 software does the rest. With the other modem you'll have to remember to check three switches, otherwise you may be answering when you mean to be originating.

Mitey Mo is half the size of the other modem. The very latest technology allows miniaturization and increased reliability, as well. Mitey Mo is so reliable, we gave it a full three-year warranty. The other modem gives 90 days, then you're on your own.

Not only will you find Mitey Mo mighty useful, you'll find it mighty reasonably priced. When you buy it, you'll get $15 of CompuServe access time and 2 hours of PlayNet free, as well. See your dealer or call us directly to order your Mitey Mo.

MODEM FEATURES	MITEY MO	COMMODORE AUTOMODEM
Auto Dial/Answer	YES	YES
Auto Redial	YES	NO
Smart 64 Software	YES	NO
Function Keys Programmable	YES	NO
Upload/Download Text & X-Modem	YES	NO
VT-52/VT-100 Emulation	YES	NO
Menu Driven	YES	NO
28K Software Buffer	YES	NO
Easy-to-Use Manual	YES	NO
Bell 103 Compatible	YES	YES
Multiple Baud Rates	YES	YES
Cable Included	YES	YES
Single Switch Operation	YES	NO
Warranty	3 years	90 days

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No matter how fast your printer is, you still have to wait for printing to finish before you can use the computer. The computer is tied up by sending characters to the printer. This can be alleviated with a printer buffer. The buffer is memory built into the printer or interface. The buffer accepts characters as fast as the computer can send them, then sends these characters to the printer at a more leisurely rate. As long as the buffer doesn't fill up, the computer is free to do other things. When the buffer fills up, the computer waits until enough of the buffer is sent out to accept more characters from the computer. If you're printing short letters, a 2K buffer is enough to quickly free up your computer. Otherwise, a buffer only shortens the time the computer is tied up.

Some interfaces include a buffer, some printers offer a buffer as an option (most have a one-line buffer by default), and you can buy a special buffer that attaches between your interface and the printer. Some buffers allow as much as 256K of buffer space, enough for a small book, but they're extremely expensive. These super-buffers often allow you to print selected portions of the buffer. One external buffer even has a video port to let you scroll through the buffer and delete unwanted data before printing.

After selecting a printer, it's time to hook it up to your computer. It's easy with Commodore printers—just plug the round serial jack into the back of your computer or disk drive. Some third-party printers also include a built-in Commodore interface. But most printers are marketed for a broad spectrum of computers.

There are two industry standard interfacing protocols: Centronics parallel and RS-232 serial. A parallel interface sends an entire character at a time, all eight bits of it, through eight parallel wires. Serial interfaces transfer characters one bit at a time over a single wire. Although serial cabling can be less expensive, a parallel interface is usually faster and easier to use. Beware of RS-232 printers for Commodore computers. Very little software supports it. Parallel interfaces attached to the user port require special software printer drivers, which are vulnerable to destruction by other RAM-resident software or require a ROM cartridge that can make the system incompatible with some programs.

The best interface for third-party printers attaches to the standard round serial port. The interface translates the serial output and sends it out over a standard Centronics parallel cable.

It's important that interfaces also translate the characters coming across. Most third-party printers use the industry standard ASCII (American Standard Code for Information Interchange) codes for sending characters as numbers. For example, the capital letter A is defined as the number 65, B as 66, lowercase a as 97, b as 98, and so on. Commodore, though, uses its own variation of ASCII, a vestige from the days of the Commodore PET. In effect, Commodore ASCII exchanges the position of upper- and lowercase in the character set. The interface must translate these nonstandard characters for the sake of true ASCII printers, or else print comes out in all uppercase or with upper- and lowercase switched.

An exception to this is when the computer is sending graphics bytes across. These bytes represent the shape of a column of dots. The translation will interpret these bytes as characters, switch them, and mangle the graphics image. Most interfaces provide a transparent mode to bypass the translation.

Also, many programs were written to work with Commodore printers, especially the 1525 and MPS-801. Some take advantage of the printer's graphics character set, reproducing the graphics characters on the keyboard. Others use MPS-801/1525 tab setting codes, reverse field, graphics mode, or setting for uppercase/graphics or upper/lowercase mode. Many printer interfaces can emulate the MPS-801/1525 for better software compatibility. With the interface, your third-party printer can act just like a Commodore printer. A graphics interface can even reproduce Commodore graphics characters, MPS-801/1525-style graphics mode, reverse field, and cursor and color control symbols. This emulation, however, can prevent you from accessing your printer's more sophisticated printing features. The transparent or graphics mode of an interface can be used to bypass the emulation when required.

Many printer interfaces include bonus features like listing mode, where cursor and color controls are spelled out, as in [CLR] for the clear-screen character. Others let you set left and right margins, skip over the paper perforation automatically, and enable/disable linefeeds.

The linefeed can be one of the biggest headaches you encounter. After a line has been printed, the printer has to do two things: move the paper up a line, and move the printhead back to the left margin. The linefeed just moves the paper up a line. A carriage return, strictly defined, just moves the printhead back to the start of the line. Many computers send a linefeed automatically with a carriage return, so the printers don't add a linefeed of their own to prevent unwanted double-spacing.

Commodore machines don't send this linefeed unless told to do so by a program, so the printer must supply these linefeeds automatically. If your printer can't do this, most interfaces have a linefeed mode or setting to do this for you. But with all these possibilities, you can get all printing on the same line (no linefeed), unwanted double-spacing (the printer's linefeed plus the interface's or computer's), even triple-spacing (everyone's sending a linefeed). It can be maddening. The solution is to make sure only one of the parties is controlling the linefeed.

Next month, we'll discuss using the printer with various kinds of software. We'll also explore programming your printer in BASIC and machine language, using your printer's fonts and styles, and solving many common printer problems. We'll look at some sample programs, including a graphics screen dump, text screen dump, and techniques for formatted output.

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User Group Update

When writing to a user group for information, please remember to enclose a stamped, self-addressed envelope.

Send additions, corrections, and deletions for this list to:

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Attn: Commodore User Groups

Announcements And Changes

A group of six bulletin board system operators (sysops) has formed in the Long Island area. Information about LISA (Long Island Sysop's Association) and its boards, which offer only public domain software, may be obtained by contacting the group's public relations officer, Frank Imburgio, 34 Inwood Rd., Port Washington, NY 11050. Phone contact may be made at the following numbers: (516) 883-7017 (home, voice); (516) 944-6860 (business, voice); or (516) 944-6594 (modem).

The Pets Around Livermore computer club (PALS) has a new president, Culley Union, and a new mailing address: PALS, P.O. Box 1068, Livermore, CA 94550.

The new address for the Napa Valley Commodore Computer Club is P.O. Box 2324, Napa, CA 94558.

Commodore Owners of Lafayette, IN (C.O.O.L.) also has a new address: P.O. Box 5763, Lafayette, IN 47903.

Another group with a new address is Louisville Users of Commodore of Kentucky (L.U.C.K.Y.). Correspondence should be sent to P.O. Box 19032, Louisville, KY 40219-0032.

A new club has formed for people interested in meeting other Commodore users around the world. For more information, contact the Commodore International Users Group, c/o Don Kovatch, 1904 Van Buren, Baltimore, MD 21222.

The Commodore 64 User Group of Southfield, MI has disbanded.

The contact person for the Mid-Missouri Commodore Club is Jim DeMian, Secretary. Correspondence may be sent to him in care of the club at P.O. Box 7026, Columbia, MO 65205-7026.

The Monadnock (NH) Commodore 64 Users Group is now the Monadnock Users Group (M.U.G.) for Commodore Owners. The new president and contact person is P. Kirkpatrick, 135 Liberty Lane, Keene, NH 03431.

The new contact person for the Tulsa Area Commodore Users Group is Craig Bowman, Secretary. The mailing address remains the same: 7804 N. 117th E. Ave., Owasso, OK 74055.

Abilene Cursor Control, P.O. Box 6261, Abilene, TX 79608, also has a new contact person, Larry Prince. Mail to the club should now be sent to his attention.

The new address for the Commodore (Houston) User Group (C.H.U.G. Inc.) is P.O. Box 612, Tomball, TX 77375. Contact persons are John and Mary Howe.

The Fredericksburg Commodore Club was incorrectly listed as the Fredericksburg Computer Club in a previous update. The group also has a new address. Send inquiries to the club's president, George Walker, c/o Shelken Associates, 313 William St., Fredericksburg, VA 22401.

In Richmond, VA, The Richmond Area Commodore Enthusiasts (T.R.A.C.E.) also has a new contact person and address: E. M. (Rex) Rexrode, Jr., 2920 Pinehurst Rd., Richmond, VA 23228.

The Lewisburg (WV) Commodore User Society has changed its name to People Addicted to Computers Klub (PACK) Program Exchange. The address remains the same: c/o David Haynes, 17 Silo Sq., Lewisburg, WV 24901.

Commodore Hobbyists Involved in Personal Systems (CHIPS) has a new mailing address: CHIPS, P.O. Box 1006, West Bend, WI 53095. Contact persons are Terry Westerbeke, President, or Dick Kraemer, Club Librarian.

In Canada, the Brantford Hackers have changed their name to STPG (Shop-Taker Programming Guild). For information, write to the club in care of Syd Bolton, 25 Frontenac Ave., Brantford, Ontario, Canada N3R 3B7.

New Listings

ARIZONA

Commodore Users Group of ARizona (COUGAR Inc.), c/o Margarete Herr, 933 S. Acorn, Tempe, AZ 85281

ARKANSAS

The Southwest Arkansas Commodore Users Group, David DuBurk, 404 S. Greening St., Hope, AR 71801

CALIFORNIA

Lowest Users Group in the United States (LUGITUS), Rusty Bayne, 650 S. Imperial Ave., Brawley, CA 92227

West Valley Commodore Users Group, Ed Brown, President, 23455 Justice St., Canoga Park, CA 91306

PLUG (Plus/4 Users' Group), Box 1001, Monterey, CA 93940

Vacaville Commodore Users Group (VCUG), E. Brecht, 530 Burlington Dr., Vacaville, CA 95688

GEORGIA

Athens Commodore Enthusiasts (ACE), Stanton Robertson, 130 St. James Dr., Athens, GA 30606

North East Georgia Commodore User Group, Randy Shuler, Rt. 2, Box 226, Oakwood, GA 30566

ILLINOIS

Fox Valley 64 Users Group, Frank Christensen, P.O. Box 28, North Aurora, IL 60542

IOWA

The John Deere Tractor Works Commodore Computer Companions, Marshall Nielsen, 7412 W. Bennington Rd., Cedar Falls, IA 50613

Syntax Errors Anonymous Commodore User Group, c/o Stephen K. Graff, R. R. Box 6845, Spirit Lake, IA 51360

Waterloo Area Commodore Club, c/o Rick Volker, 645 Lowell Ave., Waterloo, IA 50702

KENTUCKY

Commodore Users' Group of Central Kentucky, c/o John A. Rea, 173 Forest Ave., Lexington, KY 40508

LOUISIANA

Worldwide Commodore User Group, Ark-La-Miss Division, P.O. Box 371, Quitman, LA 71268

MARYLAND

Baltimore Commodore Users Group (BCUG), Steve Michalek, 402 Waverly Ave., Baltimore, MD 21225-3437

TriTech's Commodore Users Group, Brent Goldberg, 10100 Ormond Rd., Potomac, MD 20854

MINNESOTA

Redwood Falls Area Computer Exchange, James Weiss, President, 815 E. Spring St., Redwood Falls, MN 56283

NEVADA

C-RUN (Commodore Reno Users Network), Rick Cooke, Box 8566, Reno, NV 89507

NEW YORK

The Rainbow International C-64 Users' Group, Victor LaDouceur, Sr., President, 947 Harrison Ave., Niagara Falls, NY 14305

NORTH CAROLINA

Commodore 64 User Group, Timothy Macking, P.O. Box 1635, Banner Elk, NC 28604

Raleigh Area Commodore Enthusiasts, John DeVere, President, 904 Davidson St., Raleigh, NC 27609-5547

PENNSYLVANIA

Beaver County Area Commodore User's Group (B.C.A.C.U.G.), H. J. "Jack" Hemer, Secretary, 112 Spruce Dr., Monaca, PA 15061

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Port 64 User Group, Roxann Pappas, Vice President, 929 Lemmon St., Rapid City, SD 57701

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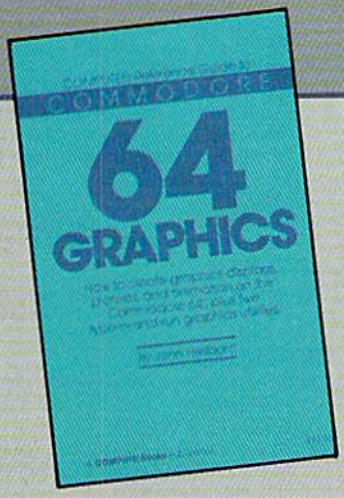

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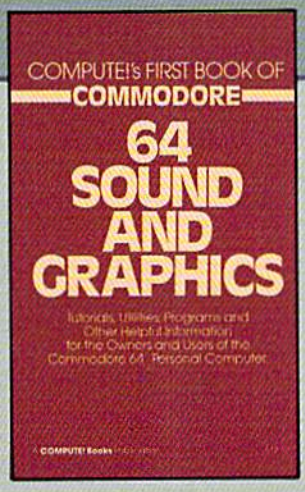

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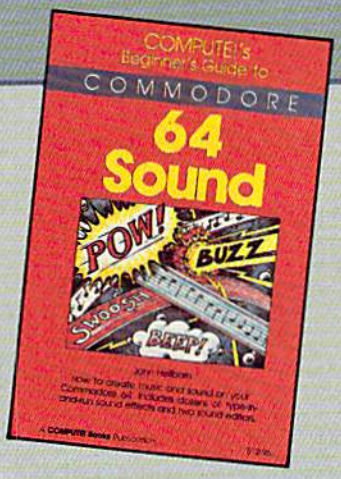

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The Great Northwest Commodore 64 Users Group, P.O. Box 380732, San Antonio, TX 78280

TOTCOM (Top of Texas Commodore), Box 2851, Pampa, TX 79066-2851

WASHINGTON

758 Commodore 64 Users Group, Makah Air Force Station, Neah Bay, WA 98357

Olympic Peninsula User Group (O.P.U.G.), Mike Ryan, President, 836 West Sixth St., Port Angeles, WA 98362

WEST VIRGINIA

The Kanawha Valley Commodore Computer Club, Floyd Steele, P.O. Box 252, Dunbar, WV 25064

Northern West Virginia C-64 Club, John W. Byam, Jr., President, 228 Grand St., Morgantown, WV 26505

OUTSIDE THE U. S.

AUSTRALIA

Commodore Computer Users Group (QLD) Inc., P.O. Box 274, Springwood Q 4127, Brisbane, Australia

Geelong Commodore Computer Club, c/o 15 Jacaranda Place, Belmont 3216, Geelong, Australia

The Griffith Computer Association, c/o Secretary, P.O. Box 425, Griffith 2680, Australia

Class of 64, c/o Robert Wheeler, 37 Kuran St., Chermiside, Queensland 4012, Australia

Commodore Computer Users Group (Townsville), 1 Paxton St., Townsville 4810, Australia

Australian Computer Education Association, P.O. Box 194, Corinda 4075, Old Australia

VIC-UPS Computer Users Group, P.O. Box 1103, Booragoon, Western Australia 6154

BELGIUM

L'Amiral Club C-64 & C-128, c/o Alain Trinteler, P.O. Box 41, B-1090, Brussels, Belgium

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Hinton Computer Club, K. Bartlett, Box 2431, Hinton, Alberta, Canada T0E 1C0

Medicine Hat Commodore Users Group, P.O. Box 764, Medicine Hat, Alberta, Canada T1A 7G7

K.C.C.U.G., Chris Larson, 195 Mars Rd., Kelowna, British Columbia, Canada V1X 1H3

International C-64/VIC-20 Users Group, c/o Jason Belsey, 22559 Hinch Cres., Maple Ridge, British Columbia, Canada V2X 7H5

Beaver Valley Commodore Club, Box 495, Montrose, British Columbia, Canada V0G 1P0

Fundy C-64 Users Group, c/o 32A Cannon Rd., Quispamsis, New Brunswick, Canada E0G 2W0

The Great White North Computer Club, T.E. Vieira, President, 358 Grenville St., Orillia, Ontario, Canada L3V 2K7

Niagara Commodore Users Group, 15A Neilson Ave., St. Catherines, Ontario, Canada L2M 5V9

Midland Commodore Users Group, c/o Frank Murphy, P.O. Box 375, Victoria Harbour, Ontario, Canada L0K 2A0

TRACK 36 Users' Club, Wayne Chapman, 491 Kenilworth Ave. North, Hamilton, Ontario, Canada L8H 4T6

C.U.G.S., Gordon Glew, 1635 Fleet St., Regina, Saskatchewan, Canada S4N 5S2

The POKEr's Club, Kris Finnestad, Box 75, St. Louis, Saskatchewan, Canada S0J 2C0

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Columbia 64 Group, c/o Rodrigo Chaves, P.O. Box 6713, Cali, Columbia, South America

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User's Club of PTT, c/o Sakari Natri, Teletutkimuslaitoksen, Mikrotietokonekerho, Kiviaidankatu 2 F, 00210 Helsinki 21, Finland

IRELAND

CLUB64, 85 Upper Drumcondra Rd., Dublin 9, Ireland

ITALY

IHT Division: Users, c/o Massimiliano Lisa, Via Borgonuovo 19, Milano 20121, Italy

Commodore 64 Computer Users Group of Rome, c/o Pluchinotta Via di S. Agnese 22, 00198, Rome, Italy

JAPAN

Commodore Users Club of Yokosuka Japan, Dennis E. Vickland, COMNAVFORJ (N-34) Box 12, FPO Seattle, WA 98762

MEXICO

Commodore 64 User's Group, APDO 86, Calle Zaragoza 414, Puerto Vallarta, Jalisco, Mexico 48300

NEW ZEALAND

East Coast Bays Commodore User Group, P.O. Box 35-034, Browns Bay, Auckland 10, New Zealand

Marlborough Commodore Users Group, Robin Vercoe, 42 Rogers St., Blenheim Marlborough, New Zealand

PAKISTAN

Commodore Computer User Club, attn: Khalid Khanani, P.O. Box 6121, Karachi-2, Pakistan

SWEDEN

Computer Club Sweden, Hans Engstrom, Secretary, P.O. Box 7040, S-103 86 Stockholm, Sweden

SWITZERLAND

C-64 Anwender Club, Postfach 194, 8029 Zurich, Switzerland

WEST GERMANY

Eifel Commodore Users Group (Bitburg/Spangdahlem/Pruem), MWR Division, APO New York 09132

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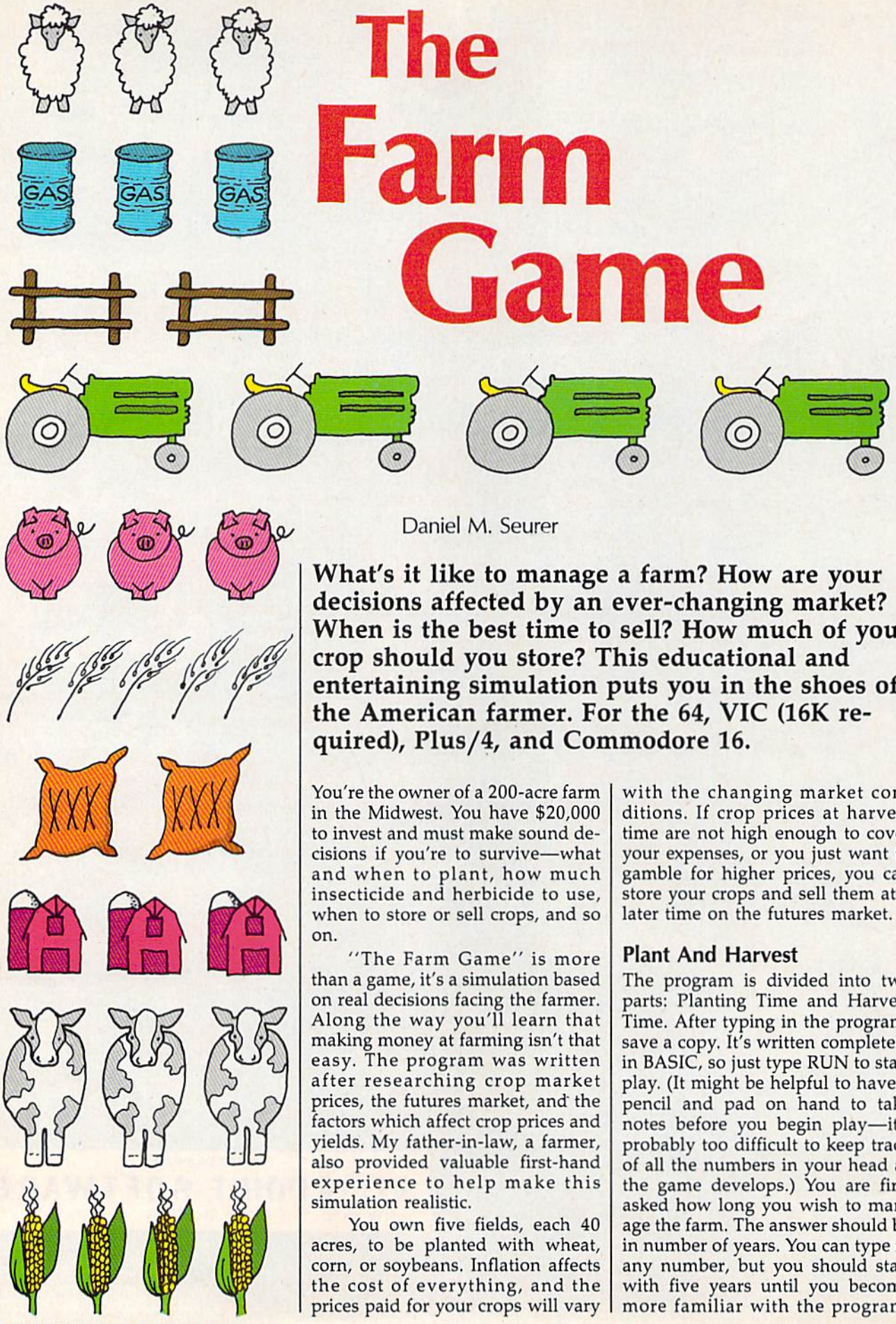

The Farm Game

Daniel M. Seurer

What's it like to manage a farm? How are your decisions affected by an ever-changing market? When is the best time to sell? How much of your crop should you store? This educational and entertaining simulation puts you in the shoes of the American farmer. For the 64, VIC (16K required), Plus/4, and Commodore 16.

You're the owner of a 200-acre farm in the Midwest. You have $20,000 to invest and must make sound decisions if you're to survive—what and when to plant, how much insecticide and herbicide to use, when to store or sell crops, and so on.

"The Farm Game" is more than a game, it's a simulation based on real decisions facing the farmer. Along the way you'll learn that making money at farming isn't that easy. The program was written after researching crop market prices, the futures market, and the factors which affect crop prices and yields. My father-in-law, a farmer, also provided valuable first-hand experience to help make this simulation realistic.

You own five fields, each 40 acres, to be planted with wheat, corn, or soybeans. Inflation affects the cost of everything, and the prices paid for your crops will vary with the changing market conditions. If crop prices at harvest time are not high enough to cover your expenses, or you just want to gamble for higher prices, you can store your crops and sell them at a later time on the futures market.

Plant And Harvest

The program is divided into two parts: Planting Time and Harvest Time. After typing in the program, save a copy. It's written completely in BASIC, so just type RUN to start play. (It might be helpful to have a pencil and pad on hand to take notes before you begin play—it's probably too difficult to keep track of all the numbers in your head as the game develops.) You are first asked how long you wish to manage the farm. The answer should be in number of years. You can type in any number, but you should start with five years until you become more familiar with the program.

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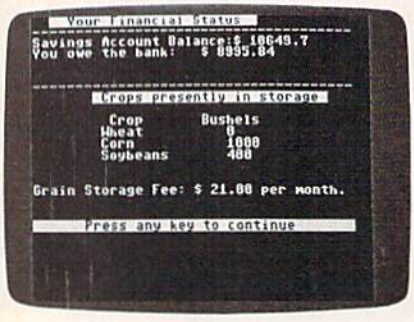
Next, the Planting Season menu is displayed. You have four choices, each selection made by pressing one of the function keys:

Planting Season

f1...Market news
f3...Your financial status
f5...Planting
f7...Sell crops on futures

Market news (f1) contains essential information for playing the game. You should always consult this item first. You'll see: 1. Yearly inflation rate, which affects all costs and can vary from 0 to 5 percent; 2. Fuel cost per gallon; 3. Herbicide and insecticide costs per unit; 4. Overhead costs (which include expenses for machinery, repairs, etc.); 5. Basic cost per acre (which includes taxes, land improvements, etc.); 6. Cost per bushel of grain seed (wheat, corn, and soybeans); and 7. Futures market price for each of the three crops. This last item is very important later in the game when it comes time to sell your stored crops. Press any key to return to the planting menu.

To review your current financial status, press f3. The screen displays the money currently in your bank account, the amount you owe the bank, the number of bushels of grain (wheat, corn, and soybeans) you have in storage, and your monthly grain storage fees (one and



Although the money situation is tight, this farmer has grain to sell later.

a half cents per month for each bushel). Again, pressing any key returns you to the planting menu.

Planting (f5) puts you into the main part of the game, which we'll look at a bit later. To sell crops, press f7. The going price was noted in the futures market item displayed in market news (f1). On your first year of play you'll have no grain in storage and therefore none to sell. When you do have grain to sell later in the game, this screen will display how many bushels of each of the three crops you have in storage as well as the current futures market prices for each of the crops.

You'll then be asked if you wish to sell wheat (f1), corn (f3),

Yearly Inflation Rate: 2%
Fuel cost (per gallon) : $ 1.35
Herbicide cost per unit: $ 1.34
Insecticide cost per unit: $ 1.47
Overhead costs: $ 2956.63
Cost per acre: $ 103.48
Seed prices
Grain seed cost per bushel
Wheat: $ 3.31
Corn: $ 87.19
Soybeans: $ 9.69
Futures Market Price
Wheat: $ 3.26
Corn: $ 2.55
Soybeans: $ 6.98
Press any key to continue

Based on the futures market, planting wheat looks like the smartest move.

soybeans (f5), or none (f7). If your response is "none" (f7), you're returned to the planting menu. Otherwise, select the crop to be sold. You're then prompted to enter the number of bushels you wish to sell (up to the total you have in storage). You can sell any amount. If you suddenly decide not to sell at this point, enter 0. After entering the amount of grain you wish to sell, you're asked if you want to sell more. Press Y if you do, otherwise, N returns you to the planting menu.

The main part of the game is Planting (f5). Unlike the other menu options above, you can't return to the menu once you've committed to planting. If you wish to look at your financial status, the market news, or sell crops on the futures market, do so before planting.

After selecting Planting, a message appears explaining that you have five fields of 40 acres each and that fields 1, 2, and 3 are average or slightly above average in yield, while fields 4 and 5 are slightly less than average producers.

For each of the five fields, you choose which of the three crops to plant. For field 1, enter 1 for wheat, 2 for corn, or 3 for soybeans, then repeat the process until all five fields have been planted. (It takes 1.5 bushels of seed to plant an acre of either wheat or soybeans, and 0.334 bushels of seed to plant an acre of corn.)

Next, the total acreage planted in the three crops is displayed and you're asked how many units per acre of insecticide and herbicide you wish to apply. Not applying enough herbicide and/or insecticide can drastically reduce your yields, but applying these chemicals beyond a certain level will not result in further benefits. The proper amount lies somewhere between 15 and 35 units per acre, but I'll leave it up to you to determine the optimal amount. Even with the correct amount applied there's still a slim chance that weeds, insects, or inadequate rainfall may reduce your yield.

After crops have been planted and the chemicals applied, the planting costs (seed, chemicals, and so on) are automatically deducted from your bank balance. If your balance drops below zero, you'll have to borrow money from the bank. The bank will let you have up to $50,000 at a yearly interest rate of 12 percent. The minimum loan payment, due at harvest time, amounts to one-third of the loan balance. If you need to borrow over the $50,000 limit, you are considered bankrupt, thus ending the game.

Reaping What You've Sown

After planting, the game moves directly into harvest time. At this point, you may sell or store your crop harvest, pay bills, and receive your futures crop check (if any).

A lot of important information appears on the screen at this time: 1. Selling price per bushel of each crop at the current market rate and the yield of each crop planted; 2. Your bank balance (after deducting planting expenses); 3. The amount of money you received from the sale of any stored crops on the futures market; 4. The value of this year's harvest if all were sold at the current market prices; 5. The minimum loan payment due; 6. Harvesting costs; 7. Fuel expense; 8. Cost per acre charges; 9. Overhead expenses; and 10. Crop storage fees. Also displayed are your total assets (bank balance + futures crop check + this year's harvest if sold at the current market rate) and your total

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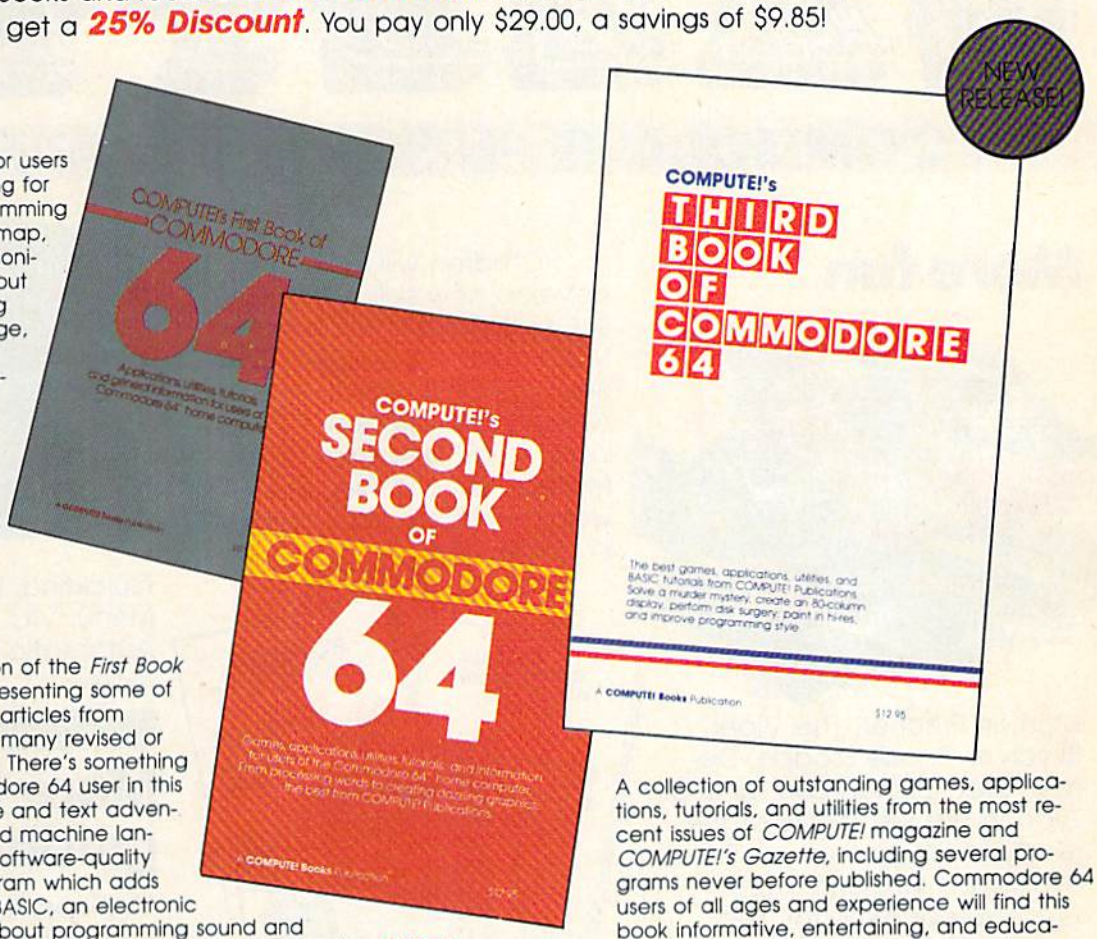
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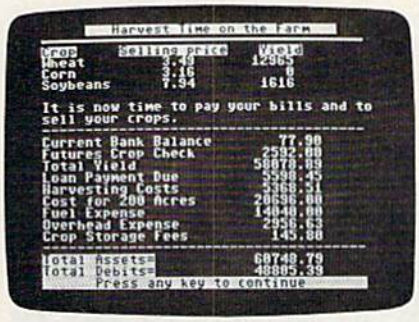
debits (loan payment due + harvest costs + fuel expense + overhead expense + basic cost per acre + crop storage fees).

Take special note of tnis information (again, writing it down can be the key to making careful decisions), then press any key to begin selling or storing your crops. You may sell all, none, or any portion of your total yield. You're asked how many bushels of each grain you wish to sell at the current market price. You may enter any number up to the total yield of that crop. Next, you're told how much money you would receive for that much grain. To change the amount, press f1 and reenter the number of bushels of grain to be sold. If the amount


Harvest time on the farm
Crop Selling price Yield
Wheat 3.49 12965
Corn 2.16 0
Soybeans 7.94 1616
It is now time to pay your bills and to sell your crops.
Current Bank Balance 77.90
Futures Crop Check 2592.00
Total Yield 58078.89
Loan Payment Due 3598.45
Harvesting Costs 3368.51
Cost for 200 Acres 20696.00
Fuel Expense 14040.00
Overhead Expense 2958.50
Crop Storage Fees 148.80
Total Assets= 60748.79
Total Debits= 40805.33
Press any key to continue

Several crucial decisions are made at harvest time.

you first entered is OK, press f3. The unsold crop balance (if any) is automatically put into storage.

After all the grain has been sold or stored, you are asked to make at least a minimum payment on your loan (if you owe the bank any money). If, after selling or storing your crops and deducting all expenses, your bank balance dips below zero, you will again need to borrow money. The minimum amount you need to borrow is also displayed. Provided you're still solvent, the program cycles back to the planting menu and the game continues into the next year.

After playing for the number of years selected at the beginning, the final screen appears. The display includes your current bank balance, the number of bushels in storage with their cash value, and the amount of money you owe the bank. These figures determine your ending bank balance. If the final balance is at or above the $20,000 you started with, you've managed to make money (or at least to break even) and can be considered a good farmer. If your balance is below $20,000, you were not successful.

Playing Strategies

Those who playtested this simulation during its developmental stages commented that this game is too much like real life—it's hard to make any money. True, it's not too easy to win, but it's not impossible either. With some thoughtful planning and good decision making (and maybe a little luck), you can make some money and win. Here are some suggestions that will help you succeed.

The amounts of herbicide and insecticide applied are crucial in determining your crop's success. As mentioned above, you should apply somewhere between 15–35 units per acre to get the best yield. The data in the table will help you decide if you've been applying enough of these chemicals. In the harvest cycle, the yield (in bushels per acre) of each crop planted is displayed. The table shows what the average yields of each of the three crops should be. Other factors can affect crop yields, but if you're getting consistently poor results, check to see if you've been applying enough insecticide and/or herbicide.

Your decision to sell or store your crops will depend on the price being paid for your crops at harvest time. If it's below the base prices for the crops shown in the table , or if you just want to gamble on even higher prices, you may want to store some or all of your harvest. But storing too much grain over a period of years can easily lead to bankruptcy, so be careful. Even though you sell your crops on the futures market at planting time, you won't receive payment until harvest time. So if your planting expenses push you over the $50,000 limit, you'll be bankrupt and the game will end.

Each of the three crops has its own special characteristics which you may want to consider at planting and selling time. Wheat and soybeans are the least expensive crops to plant while corn is by far the most expensive. However, your chances for a bumper crop (and therefore greater profit) are best with a judicious corn planting. Soybeans tend to be a steady producer, but the prices can vary greatly. The prices paid for wheat and corn tend to be the most steady.

Sometimes it will be necessary to store most, if not all, of your harvest and hope for a better price on the futures market in order to turn a profit. In this case, it may be necessary to go into debt temporarily to make money in the long run. Waiting for higher prices on the futures market can be a good way to earn a handsome profit, but if prices remain depressed for several years in a row it can be very costly (with high crop storage fees and the interest on your bank loan). Playing the futures market can either make a lot of money or result in bankruptcy.

Typing In The Program

The Farm Game, originally written for the 64, also runs on the VIC, Plus/4, and Commodore 16. All versions are in BASIC, so after typing in the program for your computer, save it, and type RUN. You should see the title screen within seconds. If you own a VIC, be sure to insert at least 16K memory expansion. Plus/4 and Commodore 16 owners must type in the Commodore 64 version and then add the substitution lines in Program 3.

If you'd rather not type in the program, I'll make a copy (64 version only). Send a tape (with at least five minutes per side) along with a self-addressed, stamped mailer and $3 to:

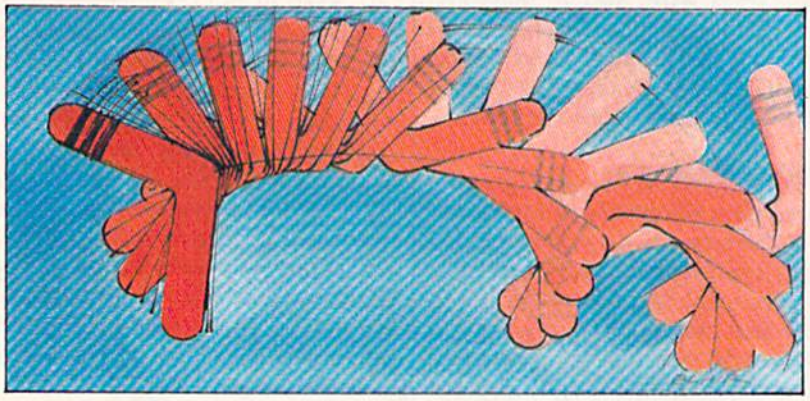
Daniel M. Seurer
6818 Schroder Rd., Apt. 5
Madison, WI 53711

See program listings on page 130.

Crop	Base Price Per Bushel	Base Yield Bushel/Acre	Fuel Costs Gallons/Acre
Wheat	$2.80	62	50
Corn	$2.33	100	85
Soybeans	$6.30	31	60

Turnabout

Mark Tuttle and Kevin Mykytyn



This fast-moving strategy game finds you in quick retreat from the intelligent but unpredictable "whirligigs." Your only hope is to trap them. For the Commodore 64. A joystick is required.

From the moment you start, you're running to escape the menacing whirligigs, intelligent boomerang-like objects that home in and try to destroy you. There's no time to catch your breath. But surviving isn't the real goal. As you avoid them, you must be planning a strategy to trap them.

Swinging Doors

Before beginning the game, be sure to have a joystick plugged into port 2 on the 64. When the game starts, you're positioned near the middle of the screen, and the whirligigs begin their relentless pursuit immediately. The screen has a gridlike appearance with green lines connecting vertically aligned dots. Each line represents a door you can swing in any of four directions (up, down, left, or right) provided the space to which you push it is vacant.

To swing a door, simply push it away from you. (Fortunately, the whirligigs cannot move the doors.) There are two very good reasons why you need the doors to work for you: first, as temporary makeshift barriers when the whirligigs are very close on your tail; and second, to box them in.

The whirligigs are almost pure energy and must keep moving to survive. If one is forced into a stationary position for even the slightest amount of time, it disintegrates. Thus, your job is to surround a whirligig by hemming it in on all four sides. Each whirligig must be surrounded by four adjacent doors—you won't destroy them if you trap two or more together.

If you wish to pause the game at any time, press SHIFT or SHIFT-LOCK. Press it again to resume play.

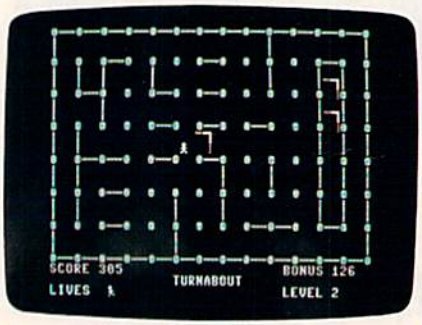
Increasing Difficulty

You begin the game at level 1 with three lives. At this point, there are only two whirligigs to contend with, but two are a handful as you'll see. By eliminating all whirligigs on one level, you progress to the next level and earn points. Each successive level (through 6) introduces one extra whirligig. At levels 7 and higher, the number of whirligigs remains the same (seven), but their speed increases while yours remains the same.

Scoring is directly related to the speed of your success. You receive 50 points for each whirligig eliminated. If you succeed in completing a level, you are awarded points equal to the time remaining on the bonus timer plus an extra 100 points multiplied by the number of the current level. You do not receive any points for just surviving.

The bonus timer starts at a number 100 times the current level and slowly winds down. If it reaches zero, the speed of both your player and the remaining whirligigs will increase until you lose a man or clear the screen of whirligigs.

The number of lives remaining is represented by the figures at the lower left of the screen. These figures include your current life. You gain an extra life after the completion of two levels, but you can never have more than three lives at any point. If you advance two levels and still possess three lives, you receive a bonus of 250 points. Any contact with a whirligig results in the loss of one life. The game is over when you've exhausted your supply of lives.



Two whirligigs are temporarily trapped, but the third is hot on the player's trail.

Remember, whirligigs are extremely intelligent and never relinquish their pursuit. It is recommended that you constantly move about to temporarily confuse the whirligigs, thus allowing time to plan your strategy.

Typing It In

Since "Turnabout" is written entirely in machine language, you must use MLX to type it in. MLX is published frequently in the GAZETTE. First load and run MLX, then when prompted for the starting and ending addresses, enter 49152 and 51569, respectively.

After typing it in, be sure to save a copy. To load, type LOAD "*filename*",8,1 and to run, enter SYS 49152.

See program listing on page 124.

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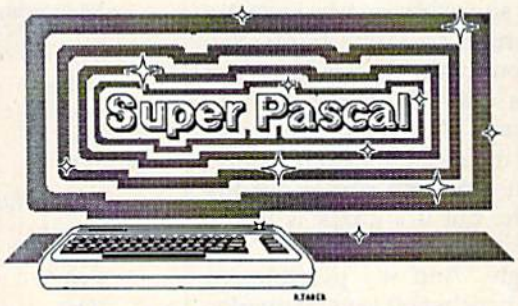

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Atom Shoot

George F. Clement

The rules are simple, but you can't win without some intelligent deductions—and maybe a little luck. A challenging game of logic for the 64, Plus/4, 16, and unexpanded VIC.

In this game, you're a physicist engaged in important research into subatomic particles. As part of the research, you must find 25 quarks within a superthin quartz crystal.

The rules are fairly simple: You shoot atoms into the small crystal (which is only 15 atoms wide, 10 atoms deep). If there are no quarks blocking the path, the atom follows a straight path and comes out the other side. But if a quark is in the way, the atom bounces away at a right angle. And it's possible for atoms to ricochet off several quarks. They might even exit exactly opposite the entry point, making it look like the atom followed a straight path.

If you think you've found a quark, you can take a guess about the quark's location and type. You gain points for a correct guess, but lose points if you're wrong. There are more points available at the beginning of the game, when fewer atoms have been used up. You have a supply of only 25 atoms, so they must be used wisely. When you've used them all, the game is over and you'll be shown any quarks you didn't find.

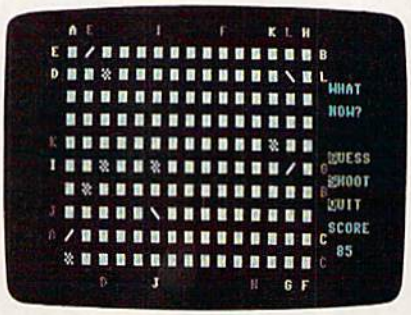
Two Types Of Quarks

Atoms shot into the grid can be deflected by one of two kinds of quarks, left-handed or right-handed. If you shoot an atom upward (from south to north), a left-handed quark changes the atom's direction to the left (or west). A right-handed quark deflects the atom to the right. The quarks act like a two-sided mirror:

Atom Shot From	New Direction
Left-Handed Quarks	
North	East
South	West
East	North
West	South
Right-Handed Quarks	
North	West
South	East
East	South
West	North

Typing Instructions

There are two versions of "Atom Shoot," one for 40-column Commodore computers (64, Plus/4, and 16) and one for the 22-column VIC.

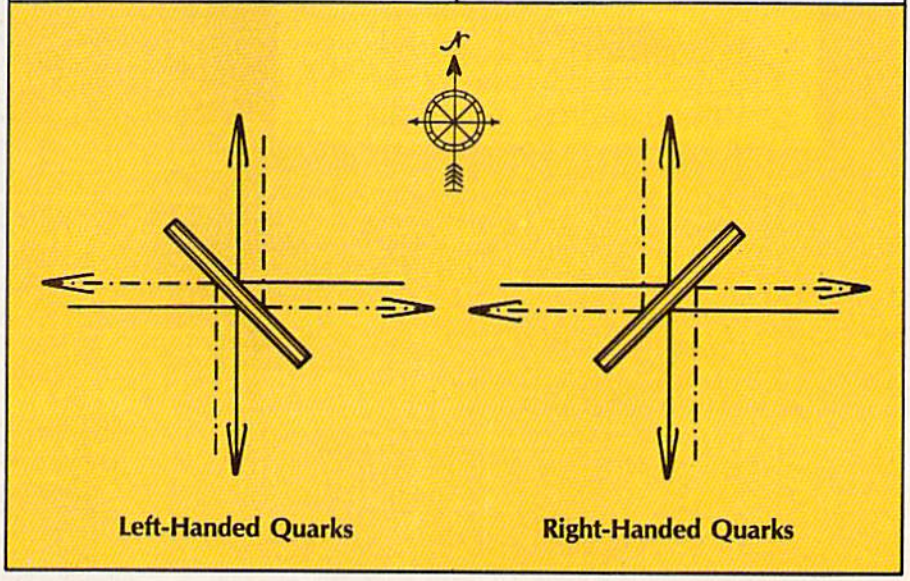


Some quarks can be found easily—others are more elusive (64 version).

Commodore 64 owners should enter Program 1 and save to tape or disk before running it. For the Plus/4 and 16, type in Program 1 (the 64 version), but substitute this line:

```
10 COLOR0,1:COLOR4,1:POKE1344,
   128:CLR:KB=239:POKE2025,255
   :ZZ=1000
```

The VIC version runs without memory expansion. Remove or disable memory, type in Program 2, and save it to tape or disk. The rules



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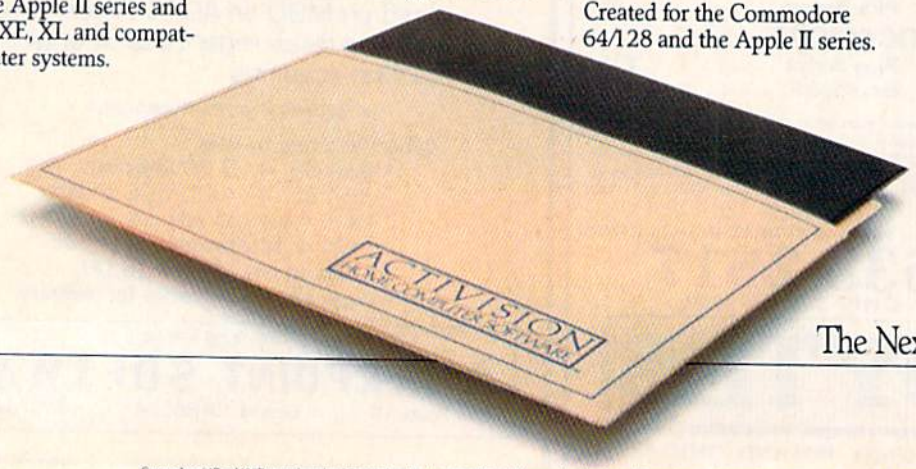
Created for the Commodore 64/128, the Apple II series and Atari 800, XE, XL and compatible computer systems.



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are somewhat different to accommodate the VIC's 22-column screen and the smaller amount of memory. See the VIC Programmer's Notes for details.

Shoot Or Guess

You have three options at the beginning of each round: shoot, guess, or quit. Press S, G, or Q accordingly. If you choose to shoot, a letter appears in the top left corner. The letters start at A, and end at Y. They represent the 25 atoms you have in supply. Use the greater-than (>) and less-than (<) keys to move the letter around the edge of the grid. When you've reached the spot you've chosen, press RETURN to shoot the atom.

The atom flies into the grid, bounces off quarks, and exits at another position, which will be marked with the same letter. The entry point will always be different from the exit (except in the VIC version—see Programmer's Notes).

After shooting an atom, you again have the option of shooting or guessing. Remember that the early guesses are worth more points. If you choose to guess, press G. The computer asks where you think the quark is: which column and which row. Next, a pointer appears in the corner. Use the "<" and ">" keys to position the pointer to the type of quark you think you've found. If the guess is right, the quark appears on the grid. If not, a checkerboard shape is printed.

The Quit option ends the game, with an invitation to play again. The game also ends after you shoot the last atom (letter Y). Either way, the undiscovered quarks are

VIC Programmer's Notes

John Krause, Assistant Technical Editor

Atoms are so tiny that we can't see them, but we know they exist. How do we know? By observing the way they affect other things.

In the VIC version of "Atom Shoot," you try to deduce the position of five atoms within an 8 × 8 matrix by bombarding the matrix with electron beams, and observing how they're affected by the atoms. The object is to use the least number of beams.

When you run the program, you'll see the space matrix in the center of the screen. It appears as a square array containing 64 possible positions for the atoms. You send a beam into the matrix by using the joystick to move the cursor to one of the 32 locations on the perimeter of the matrix, and pressing the fire button.

An Invisible Beam

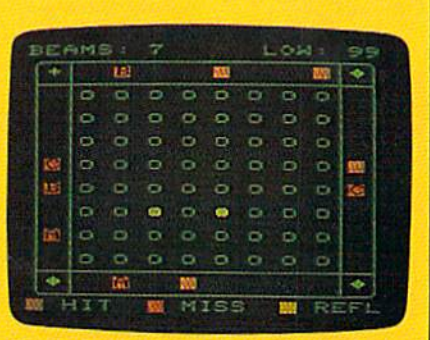
Since electron beams are invisible, you can't see the beam as it travels through the matrix. All you see is the end result. It takes about one second for the beam to complete its journey, at which point the computer records the result by placing color-coded squares on the perimeter.

Once a beam enters the matrix, three results are possible. One is that the beam exits the matrix at one of the other positions on the perimeter. This is a miss. The beam may go straight through to the other side, but if an atom is close to the beam's path, the beam will be deflected as shown in Figure 1. It may deflect off of several atoms before finally exiting the matrix. A miss is indicated by two red squares—one marking the entrance and another, the exit. To avoid confusing the squares of one miss from those of other misses, each miss is assigned a unique letter, and the paired squares are labeled with the corresponding letter.

Another possible result is that the beam doesn't exit the matrix. This is called a hit and is indicated by a purple square at the entrance. It occurs when an atom is directly in the beam's path as shown in Figure 2. The atom stops the beam by absorbing all of its energy.

A third possibility is that the beam exits the matrix at the same position that it entered. This is known as a reflection, and it can occur in two ways. One is if two atoms are on both sides of the beam's path as in Figure 3. The beam deflects off of both atoms simultaneously, causing it to reverse direction and retrace its path back to the entrance.

A reflection can also occur if an atom is adjacent to the entrance as shown in Figure 4. In this case, the beam barely enters the matrix before being deflected back out.



Winning requires strategic shots and logical thinking (VIC version).

Both types of reflections are indicated by a yellow square at the entrance.

Only One Guess

You can guess the position of the atoms at any time, but you get only one guess. If you're wrong, you lose the game, so it's best to wait until you're pretty sure you know where they all are. You make your guess by placing atom markers on five of the 64 positions within the space matrix. A marker appears as a white ball and is placed by moving the cursor to the appropriate position and pressing the fire button. If a marker is already there, it will be removed, allowing you to reposition a marker if you change your mind.

You don't have to place all five markers down at once. It's a good idea to place one down as soon as you think you know where an atom is. Your guess is not complete until

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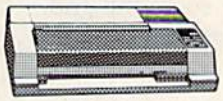

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printed to the screen in a different color.

Strategies

At the beginning of the game, shoot along the edges. Quarks there are usually easier to find.

Don't waste atoms shooting from a known exit point. Exits and entries are symmetrical (if you shoot from location A and the exit is at location B, then shooting from B will always end up at A). Pathways are also unique; each entry point has a single exit point which no other entry point shares.

Pay attention to the time the atom takes between entry and exit. Longer pathways take more time.

It helps to keep track of which pathways have been "solved." Write down the letters A–Y and cross them out when you discover an explanation for each path. When more quarks are discovered, go back and see if you can trace through the unsolved pathways.

Although it's possible for an atom to bounce off eight (or more) quarks, assume that there are only one or two bounces, until you're proven wrong. Go for the simplest hypothesis as it's often correct.

You may encounter a frustrating situation: All pathways seem to be explained, but you've discovered only 24 of the 25 quarks. In such a case, look for a path that crosses itself. There may be a quark at the intersection. When the atom reaches that point, it bounces the other way rather than traveling straight through.

It's not always possible to find every quark through logic alone. But with reason and a little luck, you can usually solve the grid.

See program listings on page 128.

the fifth marker is in place.

The moment of truth comes when you place that fifth marker. The computer compares the arrangement of the markers with that of the atoms and indicates whether all five positions match. If they don't match, you lose. If they do match, however, then you guessed correctly and your score is the number of beams used. This number is displayed at the top of the screen along with the low score.

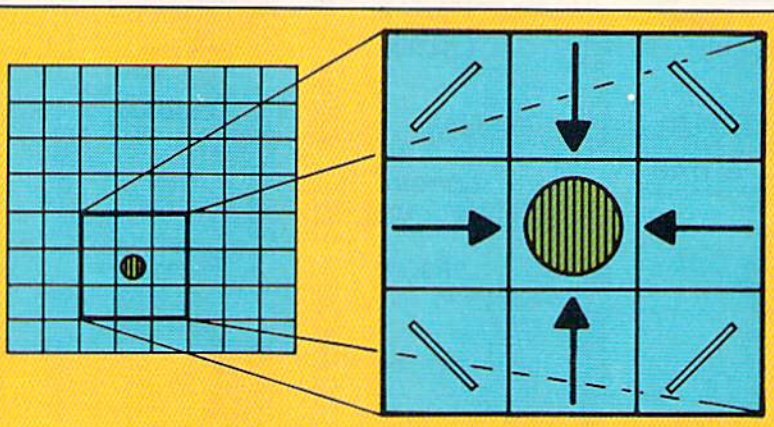
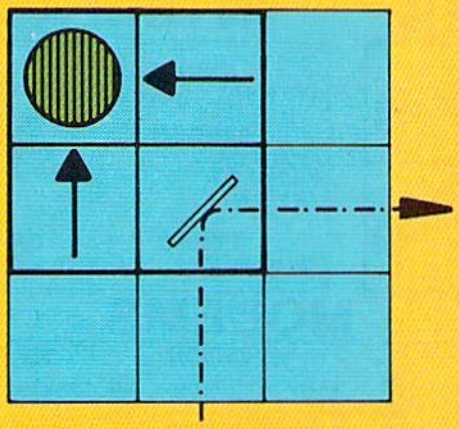


Figure 1



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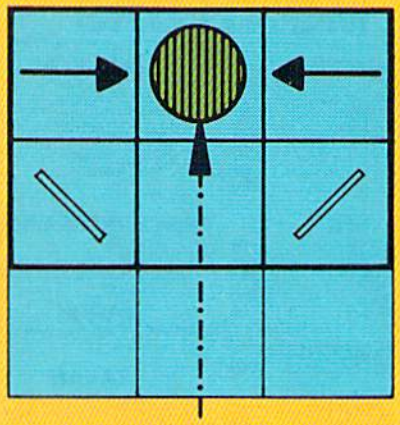

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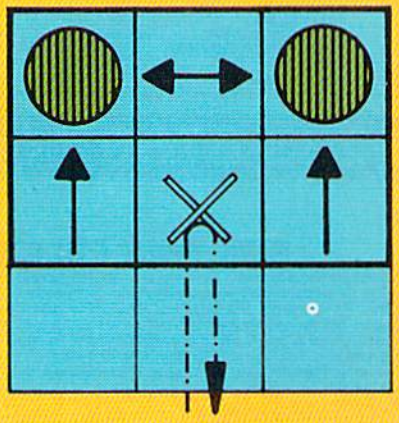
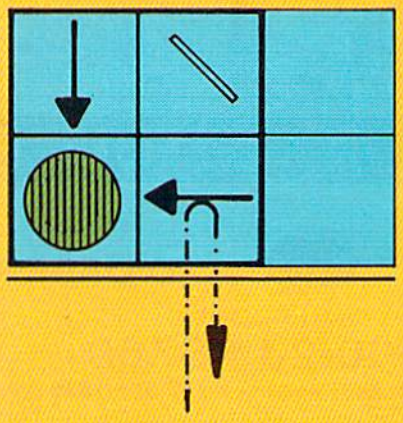


Figure 4



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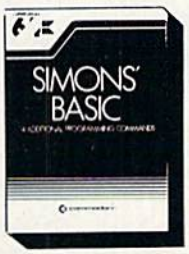

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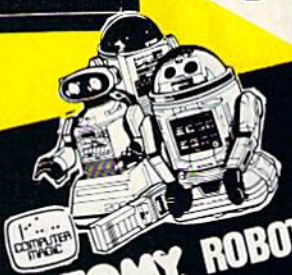

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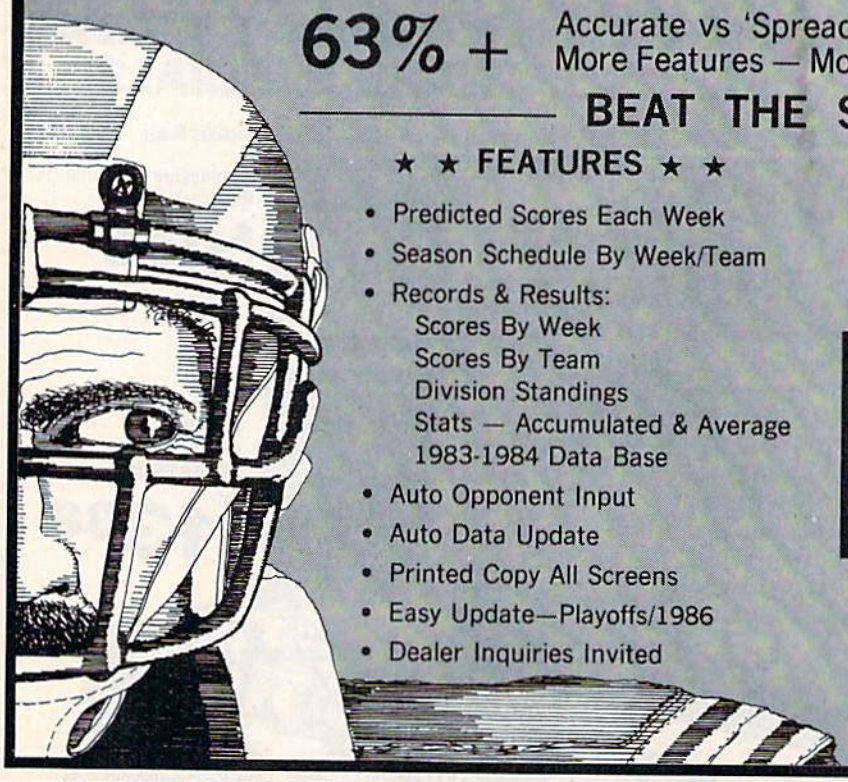

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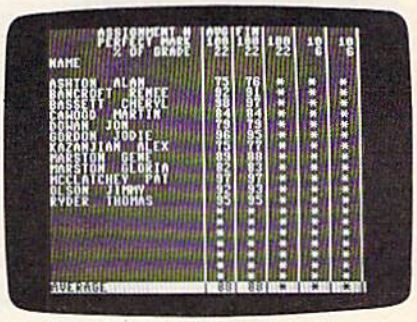
Gradebook

Stephen Levy and Kevin Mykytyn

A gradebook is an important recordkeeper for a teacher. An electronic gradebook is an efficient, convenient, and even more valuable organizational tool. This all machine language program—which includes some of the features of databases and spreadsheets—handles up to 70 students with 100 grades each. It also alphabetizes names, averages weighted grades, and much more. For the Commodore 64.

Student names may be entered in any order, and grades may be typed in and edited at any time.



A single keypress alphabetizes names, another keypress produces the final average and weighted average.

Schools continue to buy computers for students. But teachers need the time-saving convenience offered by computers as much as anyone. "Gradebook," designed especially for teachers, is a utility that efficiently handles classroom recordkeeping, replaces the periodic drudgery of averaging grades, and is easy to use.

Gradebook keeps a record of up to 100 grades for as many as 70 students in one file. In addition, the program will average grades, display them to the screen, sort (by name or grade), and print out the results.

A Great Big Work Sheet

When Gradebook is first run, you'll see a work sheet filled with meaningless characters. Press SHIFT–CLR/HOME to clear the work sheet. A gray screen with six columns filled with asterisks then appears. What you're seeing is a window on a much larger work sheet. The top row contains the assignment number, one per column. If you could view the entire work sheet, you'd see that it contains 101 columns, the first one for student names and the next 100 for individual assignments.

Press the cursor-left/right key so that the cursor is anywhere in the column for assignment 1. Now press the cursor-up/down key a few times. Notice how easy it is to move around the work sheet. If you move the cursor to the far right column and press cursor-left/right, all columns scroll to the left to make room for the next column. Pressing SHIFT–cursor-left/right moves the cursor left, and SHIFT–cursor-up/down moves it up.

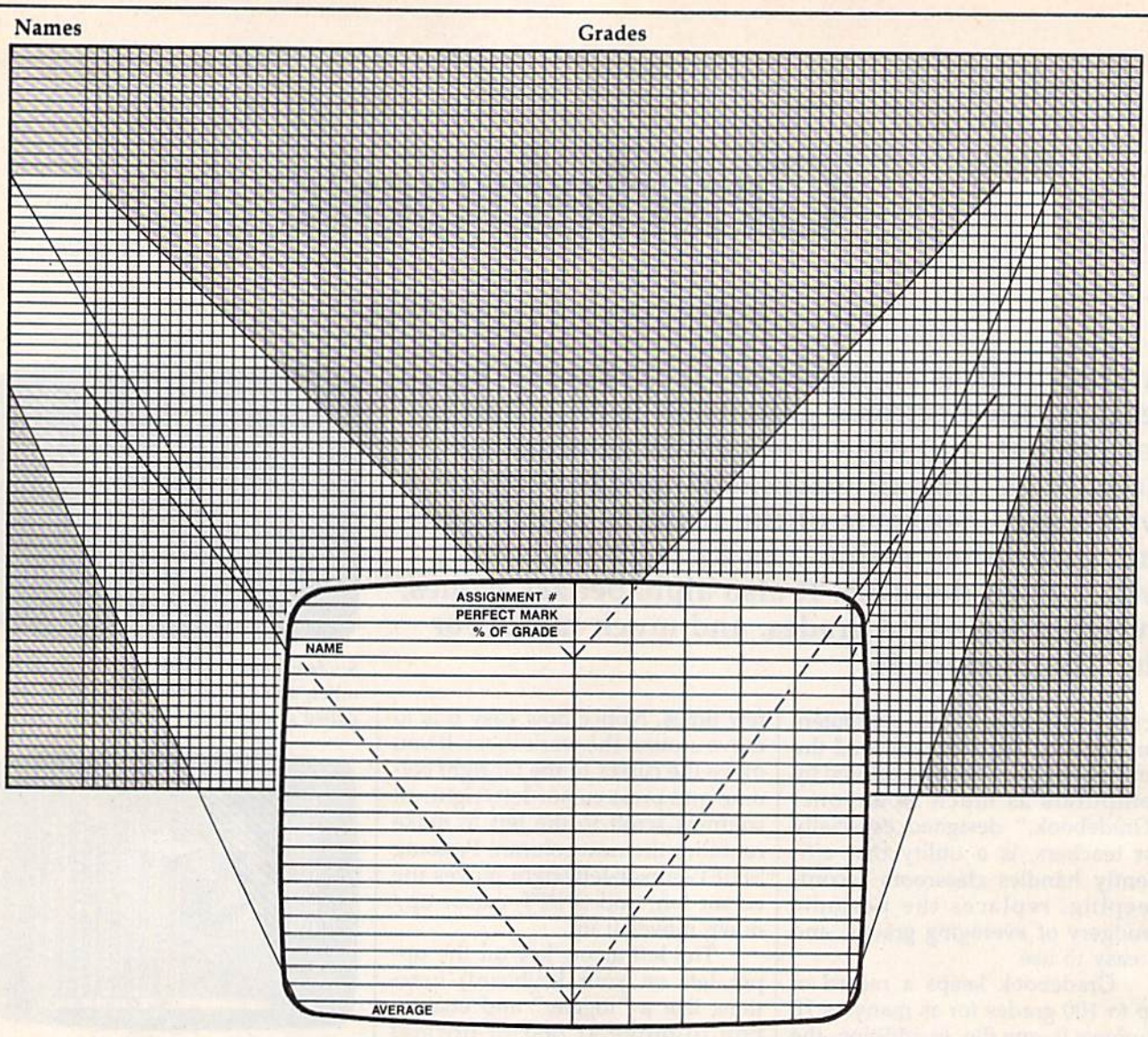
The left-arrow key (at the upper left on your keyboard) functions like a "toggle," and enables you to move at fast or normal speeds around the work sheet. To move quickly, press the left-arrow key once. Now each time you press one of the cursor-movement keys, you'll move five rows or columns. To return to single-step movement, press the left-arrow key again.

Anytime you wish to move to the top left of the work sheet, press CLR/HOME.

Entering Names And Grades

Move the cursor to the upper-left corner of the work sheet by pressing CLR/HOME. The cursor now appears as a long white bar in the column for names. Each name must start on the left margin, so be sure not to type a space as the first character. There's no need to type names in alphabetical order because the program will do that for you (see below). Be sure to enter last names first if you wish to have students alphabetized by last names. After entering a student name, press RETURN or cursor-up/down to enter another. *Do not leave blank lines between names*—each name must immediately follow the one above.

Before you can enter grades for an assignment, you must first enter the perfect mark (a whole number between 0 and 200) and percentage (weight) of grade for the assignment. To begin entering individual grades, move to the cell (column and row coordinate) for the student and assignment number you want to enter. All grades must be whole numbers between 0 and the perfect mark you've determined for that assignment. To change a student name or grade, go to the appropriate location and type it in. It will



With Gradebook, your screen becomes a window on a workspace with an effective area of more than 17 square feet.

automatically replace the old data. If you make an error while entering, use the INST/DEL key as you normally would to erase the previous character.

Calculating Grades

At the top of each column is displayed the assignment number and a place to enter the perfect mark and the percentage (weight) of the grade.

The program uses the perfect mark value for each assignment to calculate a percentage grade for each mark. This feature offers an added convenience: You don't have to figure all grades on a 100 percent base. You can enter a mark based, say, on the actual number of correct answers.

Percentage of grade allows you to give different weights to various tests, finals, midterms, and so on. For example, suppose you give seven tests during a quarter. Two of the seven are unit tests which count more heavily than the other five. All you need to do is assign a higher percentage for the unit tests. Note, however, that the total of all the percentages of grades must equal 100. In our example, we might have the two unit tests each count as 25 percent of the total and the other five tests each count as 10 percent (25, 25, 10, 10, 10, 10, 10, for a 100 percent total).

Once the perfect marks and percentages of grades are entered, press the £ key to calculate grades. You'll get two types of calculations. *Ave* is the unweighted average (all marks are added together and divided by all the perfect marks added together.) *Fin* is the weighted average, which is calculated with this formula:

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$$\frac{\text{mark\#1 * weight}}{\text{perfect mark}} + \frac{\text{mark\#2 * weight}}{\text{perfect mark}} + \frac{\text{mark\#3 * weight}}{\text{perfect mark}} \text{ and so on}$$

If the total percentage of grades doesn't add up to 100, you won't get a figure in the Fin column. Also, any student missing a grade will not have an average in the Fin column.

Press any key to return to the work sheet.

Deleting Grades And Names

Let's say you decide that all the grades for a single assignment should be eliminated. First, move the cursor anywhere on the column of grades to be deleted and press CTRL-D. When prompted, press C for column. Asterisks will fill the column. Now, you can either ignore them or reuse the column.

Likewise, if a student leaves your class and his or her grades are no longer needed, move the cursor to the row containing the student's name and press CTRL-D. But this time, when prompted, press R for row. Instantly, the row disappears and all rows below are moved up.

Deleting grades can serve another very useful purpose. At the end of each quarter or grading period, you can load in a work sheet from disk or tape (see below for loading instructions). Delete all grades, column by column, as discussed above. Then either enter new grades for the new quarter or save out just the names for later use. By saving the names using a different filename on disk or on another tape, you'll preserve the grades from the past quarter for future reference.

To delete a single grade, replace it with an asterisk. To delete all entries, both names and grades, press SHIFT–CLR/HOME. Use all delete commands carefully, as data recovery is impossible.

Saving And Loading

Once you've entered some names and grades and are ready to save the file, press CTRL-S. You'll be prompted for a filename (12 characters maximum) and asked to press T or D for tape or disk. If you use a filename that's already on your disk, it will be replaced by this new file.

Remember to save anytime you enter new names or grades. And it's best to use a different filename each time you save.

Loading is also easy: Just press CTRL-L and answer the prompts.

Printing And Sorting

Gradebook will print out any column to any Commodore printer (or any Commodore-emulating printer). To print a column, move the cursor to the desired column and press CTRL-P. *Be sure your printer is turned on before pressing CTRL-P. Otherwise, Gradebook will print to the screen, scrambling the format you've set up.*

If you ask for a column of grades, the name of each student will appear with the student's grade for that one assignment. If the cursor is in the column of student names and you ask for a printout of the column, you'll get a list of student names.

To get a printout of all student averages, press £ to go to calculations. Once the averages are displayed, press CTRL-P.

CTRL-A will sort any column. Move the cursor to the column with the student names, press CTRL-A, and the names will be sorted in alphabetical order. And the grades will move to the proper row. Place the cursor in a column of marks and press CTRL-A, and that list will be arranged in descending order. Again, all corresponding data will be rearranged.

The sorting function gives Gradebook flexibility. You could sort assignment 1 and then print out all the student grades for assignment 1. This would give you a list of names and grades, sorted by grades from highest to lowest. You can save multiple files with the same data, but sorted and arranged in different ways.

Gradebook has only a few commands, but, as with any program, it takes a little getting used to. The first few times you use the program, refer to the table of commands. Once you've used it a bit, you'll find that entering and averaging grades will be quick and easy.

Typing It In

Gradebook is written entirely in machine language, so you must use "MLX," the machine language entry program published frequently in the GAZETTE. After typing in and saving MLX, run it and enter the following information when prompted:

Starting address: 49152
Ending address: 52259

Once Gradebook has been saved to disk or tape, load it with

LOAD *"filename"*,8,1 for disk

or

LOAD *"filename"* for tape

where *filename* is the name used to save Gradebook using MLX. Once the file is loaded, type NEW, press RETURN, and enter **SYS49152** to activate the program.

See program listing on page 138.

Gradebook Command Summary

CTRL-A	Sort row or column
CTRL-D	Delete row or column
CTRL-L	Load names and grades from tape or disk
CTRL-P	Print row or column
CTRL-S	Save names and grades to tape or disk
SHIFT-CLR/HOME	Delete all entries
£	Calculate averages
cursor-left/right	Move cursor right
SHIFT-cursorleft/right	Move cursor left
Cursorup/down	Move cursor down
SHIFT-cursorup/down	Move cursor up
CLR/HOME	Move cursor to upper left
←	Toggle cursor speed control

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The Evelyn Wood Dynamic Reader

Whatever criticism speed-reading has received, the fact remains that it has a valid purpose. Much of our reading is perfunctory, and it would be nice to get through it more quickly. No one is going to suggest reading *King Lear* or *The Sound and the Fury* using the Evelyn Wood method, but anyone who has ever waded through a poorly written feasibility study, or an encyclopedia article from which you want only one fact, knows how time-consuming and boring such things can be. Speed-reading can help improve both speed and comprehension, allowing us to make more efficient use of our reading time.

Billed as "Personal Improvement" software, the *Evelyn Wood Dynamic Reader* uses your 64 as a speed-reading instructor. A detailed, informative manual explains the techniques, goals, and functions of the Evelyn Wood concept of dynamic reading. The basic training includes making use of your index finger as a "pacer," and teaching your eyes to move where you want them to. The idea is to eliminate the tendency to reread, usually caused by allowing the mind to wander. Speed-reading is mostly an exercise in intensive concentration, and this Timeworks program provides the appropriate materials.

Each person using the *Dynamic Reader* must use his own data disk, on which the program records his progress. You begin by reading one of the ten passages provided in a book of readings; the computer times you and presents a ten-question quiz to test your comprehension. The program then records the results—reading speed and comprehension—on your data disk and displays them on the screen. Referring to these results, you set speed and comprehension goals for yourself, and the date by which you want to attain them. For example, if you're currently reading at 300 words per minute (about average), with a 70 percent comprehension rate, you may decide you want to attain 450 words per minute and an 85 percent comprehension rate at the end of five weeks. You enter this, and the program stores it on the data disk.

Each time you perform a reading, the program updates your progress. You can ask for a progress report whenever you wish; the screen displays a graph of the results of each reading, or you can dispense with the graph and just view the numbers. There are ten passages in the Readings book and ten more on the disk. While there is no provision for entering your own readings, there are detailed instructions for working with outside sources and keeping the results meaningful. We can hope that Timeworks will provide periodic disks full of new readings, if only to keep us in practice.

In addition to the Readings and Reports, the Dynamic Reader offers several types of skills and drills. The Phrase test, for example, displays a phrase followed by several one-line sentences. Only one of the sentences contains the exact phrase, while the others each have a close approximation. When you see the sentence with the exact phrase, you type the corresponding number beside the sentence and the computer keeps track of your time. In addition to Phrase tests, there are Character and Word tests, and Eye exercises. The drills force you either to reread a passage in progressively less time, or to read progressively more material in a given amount of time.

If you set a regular schedule (daily or every other day) and stick to it, the *Evelyn Wood Dynamic Reader* can help your reading. Like all personal improvement programs, though, whether computerized or not, it will be effective only if you make such a commitment. But this program is detailed and highly useful, and it is designed to be easy to

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PROMAL

PROMAL, the PROgrammers Micro Application Language, is a program development system for the Commodore 64. In addition to the PROMAL language—similar in structure to C or Pascal—several utilities for writing and debugging programs are included in the package, as well as complete documentation and a tutorial to help get you started.

You enter programs (as source code) via the Editor, which is as good as some commercial word processors. Block moves and deletes are achieved through highlighting, and editing commands such as global search and replace are supported. The use of each function key is displayed in a window at the bottom of the screen. To assist you in remembering the commands, a help screen is available at all times.

The language allows complex constructs such as IF–THEN–ELSE and REPEAT–UNTIL. There are 45 Library commands which handle most of the input/output. One strong feature of PROMAL is the ability to direct output to any one of many devices. Included on the program disk are a set of mathematical and trigonometric functions, a set of RS-232 commands, and a series of relative file commands. In comparing PROMAL to other languages and compilers, it stands up to SMA's claim that it runs 70–200 percent faster than other languages for the 64.

The PROMAL Executive operating system replaces the BASIC interpreter within the computer. From the Executive, you control the entire PROMAL system. The Executive's 24 commands allow you to display areas of memory, access files, and manage the system. There is also a complete help screen.

PROMAL includes a very fast, one-pass compiler. It takes a source file as input and generates an object file, a program. If the compiler finds an error, it stops and asks if you want to edit the program. The compiler also supports recursion. When it finishes compiling, it gives a byte count and returns you to the Executive. To run the program, just type its name. If PROMAL doesn't find

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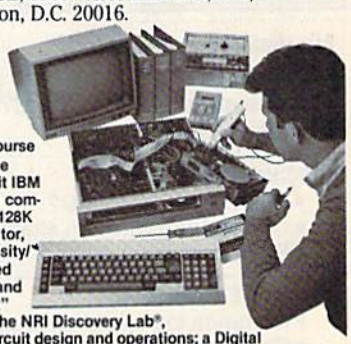

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it in memory, it checks the disk drive.

The documentation is a 200-plus page manual which consists of three parts: a tutorial, a PROMAL users' guide, and a reference manual. The books are well written, although they leave a bit to be desired when it comes to programming graphics and sound.

Overall, PROMAL is a very good addition to any 64 programmer's library.

—Tom Emerson

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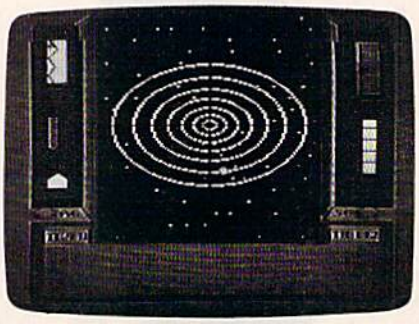
The Argos Expedition

Since playing games is a social activity, it seems a bit strange that solitaire gaming is so popular. A controversial issue in gaming magazines for the past decade, solitaire play has been encouraged by electronic games of all types. There is a reason for this: If you want a computer game to sell, it must have a solitaire option.

The Argos Expedition is thus a bold experiment. It encourages cooperation, and it does not include a solitaire mode. Playable by two, three, or four players, only with four does it show its full potential. Its subtitle, "Work Together to Conquer the Final Frontier," sums up the game's purpose quite nicely. *The Argos Expedition* demands that players work together.



The game is graphically excellent, and it includes a lovely theme song reminiscent of "Chariots of Fire." The players control a spaceship whose goal is to track down alien artifacts and bring them back to mission control. The first player uses the keyboard, the second a joystick, and the other two use paddles. (This is probably the game's only serious limitation, since not everyone has paddles.) To capture the artifact and avoid obstacles, the players have to use their controls together. The game makes creative use of sound and graphics to make the cooperation both challenging and exciting.

But players also have a secret personal goal, determined by selecting a "goal" card before the mission starts. They're forced throughout the game to weigh personal goals against the needs of the overall mission. The game designers want to demonstrate that this is what social activity is about, and they succeed admirably. Players bid with each other to conduct tests, and at some points they may have to burn an artifact to get energy for the ship. The advanced game includes a secret goal called space sickness, which further complicates matters.

The game requires a lot of thought for all four players. Designed for an age group from 10 to 16, it should appeal to older groups as well. With its demand for cooperation in the face of personal advancement, it's a perfect investment for schools and gaming clubs.

—Neil Randall

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Know Your Own I.Q./Know Your Own Personality

"Self-enrichment software" is hot right now, and Bantam enters the field with two programs for the 64 on the same disk—*Know Your Own I.Q.* and *Know Your Own Personality.* I.Q. (intelligence quotient) is a very controversial topic. Experts don't agree on what intelligence means, how it should be tested, or even if it exists. However, this test was developed by two of the best in the field of human intelligence, H. J. Eysenck and Glenn Wilson.

Like other I.Q. tests, *Know Your Own I.Q.* is very tough. People who consider themselves geniuses may be in for a rude awakening. The program contains four I.Q. tests. Each has 40 questions, which must be completed in 30 minutes (there's a time clock on-screen). Some of the questions are verbal, others are graphic. Results can be printed out.

Bantam wants you to know your I.Q., but they don't want to hurt anyone's feelings. You only receive a specific numerical score if your I.Q. falls between 100 and 130. The computer will inform you if you've scored below or above that range, but it won't tell you the exact score. So the smartest and dumbest people don't learn their I.Q.

The *real* power of this test is that it can be used to practice for future I.Q. tests. Unlike others, this one tells you the correct answers afterward and tells you why each answer was correct. When you read the explanations, you can learn how to get the same question right on an I.Q. test in school or at work. This program can possibly help you raise your I.Q. score, though Bantam never mentions this with the program.

In *Know Your Own Personality,* the computer asks 210 yes/no questions ("When climbing stairs, do you generally take them two at a time?") to test for three personality traits: Extraversion/Introversion, Emotional Stability/Adjustment, and Tough-/Tender-Mindedness. At the end of the test you're presented with bar charts comparing your various traits, and a paragraph describing your personality.

Like the I.Q. test, the personality test may bring bad news. You may find out, "You have a low opinion of yourself. You believe you are an unattractive failure. You are characteristically pessimistic, gloomy and depressed. You are disappointed with your existence and at odds with the world."

I.Q. and personality tests work perfectly well with pencil and paper. The advantage of the computer is that you get your results about a second after completing the last question of the test. This program can help you understand yourself or another person better, and it can be a lot of fun—as long as you're intelligent and have a sparkling personality. Of course, the computer may also tell you that you're not so smart and have a *bad* personality. That's a chance you'll have to take.

—Dan Gutman

Bantam Software
666 Fifth Ave.
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$34.95 (disk)

Donald Duck's Playground

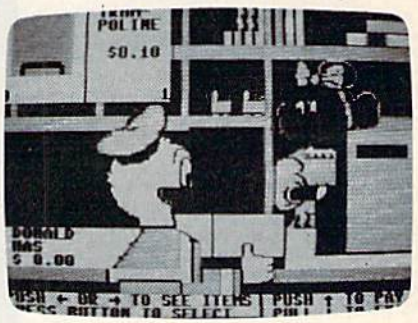
This educational program uses the popular Disney cartoon character, Donald Duck, and his three nephews in a game format for children ages 7 to 11. Available for the Commodore 64, it does an excellent job of teaching the basics of money handling, sorting items, and making logical decisions. Using a joystick to move Donald around town, the player has him work for money, then spend what he's earned on playground equipment for Donald's nephews, Huey, Louie, and Dewey.

Donald may work at any of four places: McDuck Airlines, where he sorts and moves packages from a conveyor belt to an airplane baggage tram; a produce market, where he catches produce thrown from a truck and drops it into the correct bin; a toy store, in which he places toys on the appropriate shelves; and the Amquack Railroad, where Donald is in charge of the junction switches for the trains delivering packages. You choose the length of time for a work shift, then get paid according to your performance.

Across the street are three stores from which Donald purchases items for the playground. He can shop at Minnie's 5 & 10, Mickey's Hardware Store, and Goofy's Junk Shop. At each store you flip through catalog pages to see what items may be purchased. But you're not allowed to select something if there isn't enough money in Donald's account.

To pay for an item, a cash register is displayed at the top of the screen, and Donald's account at the bottom. Using a joystick, you select coins and place them at the top, then point to the TOTAL key on the cash register. If you've overpaid, a cash drawer comes out so you can receive your change.

The next activity is constructing the playground with the items purchased. Move Donald to the end of the street, across a railroad track, and into the park. (As Donald moves to the track, he always checks both ways to be sure there are no trains approaching.) With the joystick, you build and arrange playground equipment, then press a key to see one of Donald's nephews at play.



A young child may need help from an adult to understand the instruction manual the first time, but then he or she can easily enjoy the program alone. The variety of activities step a child through many important learning procedures, and the program is so much fun it will hold a child's interest for hours.

—C. Regena

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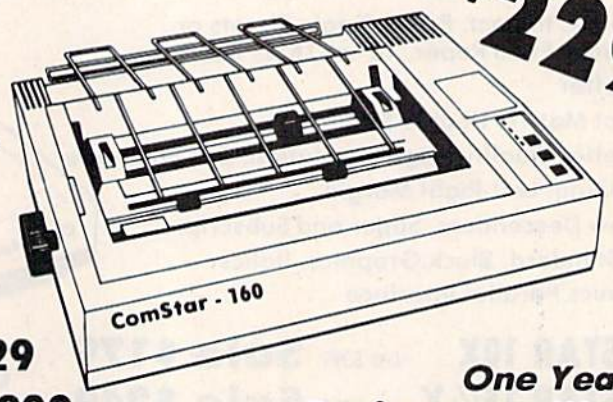

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GIANT PRINTER SALE

10" ComStar 2000 165-185 CPS

Super Letter Quality 10" ComStar 2000 Plus Super High Speed

Lifetime Warranty*

- Tractor Friction Printer
- 165 - 185 CPS Dot Matrix Impact, prints single sheet or continuous form paper
- Letter Quality Mode 40 CPS
- 9x9 or 17x17 dot matrix
- 256 user definable characters
- Super script, subscript
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- Super bit image graphics
- 1920 byte print buffer
- **Lifetime printhead warranty***
- Better than Epson FX80
- Automatic dark mode

$259.00

One Year Free Replacement Warranty

10" ComStar 2000 List $599 **Sale $259**

PRINTING METHOD	**VERTICAL TAB**
Impact dot matrix system	Programmable
PRINT SPEED	**LINE FEED PITCH**
160-180 cps PICA; 40 cps FINE MODE (Letter Quality)	1/6", 1/8", 7/72" (programmable pitch), 1/72" (programmable pitch), n/72" (programmable pitch), n/216" (programmable pitch)
PAPER FEED SPEED	**CHARACTER SET**
100 msec/line (in case of 1/6 inch line feed)	Full ASCII 96 characters with descenders. International characters: USA, Germany, Italy, U.K., France, Denmark, Sweden, Spain
CHARACTER FONT	**PAPER FEED SYSTEM**
9x9 matrix (pica, elite, condensed), 9xn matrix (proportional), 17x17 matrix (fine mode) 2 pass	Adjustable sprocket feed, friction feed
BIT IMAGE GRAPHICS	**FORM HANDLING, FANFOLD PAPER**
480, 640, 960, 1280, 1920 dots/line	Width: 4-10"; number of copies, original & 2 copies without carbon
PRINT DIRECTION	**RIBBON**
Bi-directional in text mode with logic seeking Uni-directional in bit image graphic mode	Cartridge ribbon
CHARACTER PITCH	**PAPER END SENSOR**
1/10" (pica), 1/12" (elite), 7/120" (condensed), 2/10" (double width pica), 2/12" (double width elite), 14/120" (double width condensed)	Mechanical switch (printer stops printing 0.6 inches from end of paper)
CHARACTERS PER LINE	**INTERFACE**
137 characters (condensed) 96 characters (elite) 80 characters (pica) 68 characters (double width condensed) 48 characters (double width elite) 40 characters (double width pica)	Parallel (Centronics compatible) Buffer memory size: 1920 byte
HORIZONTAL TAB	**RELIABILITIES: PRINTER LIFE**
Programmable positions & manual selection by control panel switches	MTBF: 5,000,000 lines; ribbon life, 3,000,000 chars.
	DIMENSIONS & WEIGHT
	Width 16.0"; depth 11.8"; height 4.72"; weight 14 lbs.

All product data subject to change without notice.

Parallel Interfaces: Commodore 64 — $39.00 Apple II,IIe,II+ —$59.00 Atari — $59.00

Add $10.00 for shipping, handling and insurance. Illinois residents please add 6% tax. Add $20.00 for CANADA, PUERTO RICO, HAWAII, ALASKA, APO-FPO orders. Canadian orders must be in U.S. dollars. WE DO NOT EXPORT TO OTHER COUNTRIES, EXCEPT CANADA.

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Commodore 64

MODEM

Commodore 64

SAVE

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Sale $39.95

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Telecommunications

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Lowest Price In the U.S.A.

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Complete Auto Dial Telecommunications Package

"The only telecommunications package you will ever need."

(Exclusive Easy To Use Features)

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NEW

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• 52 Database Services (UPI News, etc.) Phone Numbers Included

Reach Out and Access Someone

- Educational courses
- Financial Information
- Banking at Home
- Popular Games
- News Updates and Information
- Electronic Shopping
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The Total Telecommonications Package offers you all this plus ...

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- Capture and Display High Resolution Characters
- Download Text, Program or Data Files
- Stores on Disk Downloaded Files
- Reads Files from Disk and Uploads Text or Program Files
- Select Any Protocol (access almost any computer or modem)
- Plus Much, Much More

List $99.00 **Sale $39.95** *Coupon $29.95*

We are so sure this is the only telecommunications package you will need we will give you 15 days Free Trial.

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16 COLORS

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- **For Video Recorders**
- **For Small Business Computers**
- **Apple - Commodore - Atari - Franklin - etc.**

(Premium Quality)

- **Beautiful Color Contrast**
- **High Resolution**
- **Separated Video**
- **Sharp Clear Text**
- **Anti-Glare Screen**
- **40 Columns x 24 Lines**
- **Supports 80 Columns**

List $329.00

Add $14.50 shipping, handling and insurance. Illinois residents please add 6% tax. We do not ship to foreign countries (including Canada), Alaska, Puerto Rico, APO-FPO.
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13" Color Computer Monitor *Connecting cable $9.95

Sale $169.95*

13" RGB & COMPOSITE MONITOR List $399.00
Must be used to get 80 columns in color with 80 column computers (C128 & Atari ST). (add $14.50 shipping)
Sale $279.00*

14" COMMODORE 1702 COLOR MONITOR List $299.00
(add $14.50 shipping)
Sale $179.00*

15 Day Free Trial - 90 Day Immediate Replacement Warranty

12" XTRON SUPER HI-RESOLUTION MONITOR
80 Columns x 24 Lines, Super Hi-Resolution 1000 lines Green or Amber
Super-Clear "Easy to Read" text with special anti-glare screen! *(Ltd. Qty.)* List $249.00
Sale $109.95*

12" ZENITH HI-RESOLUTION GREEN OR AMBER TEXT DISPLAY MONITOR
80 Columns x 24 Lines, Hi-Resolution, crisp clear easy to read text with anti-glare screen! A MUST for word processing. *(Ltd. Qty.)* List $199.00
Sale $89.95*

12" MONITOR GREEN OR AMBER TEXT List $159.00
80 Columns x 24 Lines, easy to read up front controls *(Ltd. Qty.)*
Sale $69.95*

* Connecting cable $9.95

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WORD PROCESSING BREAKTHROUGH!

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40 or 80 Columns in Color

Paperback Writer 64

40 or 80 Columns in Color

This is the easiest to use and most powerful word processor available for the Commodore 64. As you type on the screen, you will see your letters and words appear on the screen exactly as they will be printed (i.e. Italics will be *Italic*, Bold Face will be **Bold Face**). With the printer files you can customize Paperback Writer 64 to use all the fancy features of your printer. Loads EZ Script®, Paperclip®, & Wordpro 64® Files so you can easily upgrade your past wordprocessing text that you've written with obsolete wordprocessors. Take a look at some of the other features:

- **Wordwrap** — No Words Break At The Edge Of The Screen.
- **Flexible Cursor Movement,** Including Tabs And Other Timesavers.
- **Deletion And Insertion** Of Characters, Lines And Blocks Of Text.
- **On-screen Text Enhancement**, Such As Bold Face, Italics, Underlining, Superscripts And Subscripts, And Foreign And Other Characters.
- **Manipulation Of Blocks (ranges)** Of Text For Functions Such As Moving And Deleting, Even Between Files.
- **Sorting Lists** In Order Of Numbers And Letters.
- **Aligning And Adding Numbers** In Columns, Helpful With Tables.
- **Variable Margins** At Left And Right, And Paragraph Indentation.
- **Lines Centered, Justified** Or **Aligned** At The Right Side.
- **Variable Page Lengths** And **Line Spacing.**
- **Borders** At Top Or Bottom With Optional Title Lines And Page Numbers.
- **Linked Files** To Print Extra-long Documents In Sequence.
- **Flexible Printer Set-up** To Allow Use With Any Printer.
- **Find And Replace** Text Functions That Can Be Automatic.
- Complete Or Selective **Directories** Of Files On The Disk.
- **Sequential Files** For Mail Lists And Communication With Other Computers.
- **Spelling Checker**, Checks Your Spelling.

INTRODUCTORY PRICE

$29.95

COUPON

Sale Price $39.95

☆ ☆ ☆ **Plus** ☆ ☆ ☆

Full help screens on line with additional help on the disks mean you don't even need a manual. If you're in the middle of a page and you want to know how to use a special function just hit F7 and the information will appear before your eyes. If you still don't understand hit F7 again and a more detailed explanation appears. Then simply hit F8 and you're back in the letter where you left off. No manual lookup necessary. This is the easiest word processor in the world to use. List $99.00.
Introductory Sale Price $39.95. *Coupon $29.95.*

DOUBLE PROTECTO FREE TRIAL
We are so sure this is the easiest and most powerful word processor available, we will give you 30 days to try it out. If you are not completely satisfied, we will refund your purchase price.

PAPERBACK DATABASE (Datafax) List $69.00. **Sale $34.95.** * *Coupon $24.95.*

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Super Summer Sizzler Sale Ends 9-15-85

Prices will go back to regular sale prices

FLOPPY DISKS SALE *69¢ ea.

Economy Model or Cadillac Quality

We have the lowest prices!

ECONOMY DISKS** — ***Summer Sale Prices Only

Good quality 5¼" single sided single density with hub rings.

Bulk Pac	100 Qty.	69¢ ea.	Total Price	$69.00
	10 Qty.	89¢ ea.	Total Price	8.90

CADILLAC QUALITY (double density)

• Each disk certified ***• Free replacement lifetime warranty*** ***• Automatic dust remover***

For those who want cadillac quality we have the Loran Floppy Disk. Used by professionals because they can rely on Loran Disks to store important data and programs without fear of loss! Each Loran disk is 100% certified (an exclusive process) plus each disk carries an exclusive FREE REPLACEMENT LIFETIME WARRANTY. With Loran disks you can have the peace of mind without the frustration of program loss after hours spent in program development.

100% CERTIFICATION TEST

Some floppy disk manufactures only sample test on a batch basis the disks they sell, and then claim they are certified. Each Loran disk is individually checked so you will never experience data or program loss during your lifetime!

FREE REPLACEMENT LIFETIME WARRANTY

We are so sure of Loran Disks that we give you a free replacement warranty against failure to perform due to faulty materials or workmanship for as long as you own your Loran disk.

AUTOMATIC DUST REMOVER

Just like a record needle, disk drive heads must travel hundreds of miles over disk surfaces. Unlike other floppy disks the Loran smooth surface finish saves disk drive head wear during the life of the disk. (A rough surface will grind your disk drive head like sandpaper). The lint free automatic CLEANING LINER makes sure the disk-killers (dust & dirt) are being constantly cleaned while the disk is being operated. PLUS the Loran Disk has the highest probability rate of any other disk in the industry for storing and retaining data without loss for the life of the disk.

Loran is definitely the Cadillac disk in the world

Just to prove it even further, we are offering these super LOW INTRODUCTORY PRICES

List $4.99 ea. INTRODUCTORY SALE PRICE $2.49 ea. (Box of 10 only) Total price $24.90

$3.33 ea. (3 quantity) Total price $9.99

All LORAN disks come with hub rings and sleeves in an attractive package.

DISK DRIVE CLEANER $19.95

Everyone Needs A Disk Drive Doctor

FACTS

- 60% of all drive downtime is directly related to poorly maintained drives.
- Drives should be cleaned each week regardless of use.
- Drives are sensitive to smoke, dust and all micro particles.
- Systematic operator performed maintenance is the best way of ensuring error free use of your computer system.

The Verifin disk drive cleaner can be used with single or double sided 5¼" disk drives. The Verifin is an easy to use fast method of maintaining efficient floppy diskette drive operation. The Verifin cleaner comes with 2 disks and is packed in a protective plastic folder to prevent contamination. List $29.95. **Sale $19.95.** ** Coupon $14.95.*

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Commodore 64 SALE **CARDCO** Commodore 64 SALE

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S'MORE Cartridge Sale $49.95

57% More Memory For BASIC ***C128 Programming on your Commodore 64***

For the first time, the Commodore 64 computer owners can make use of the full memory that came inside their Commodore 64 without having to learn sophisticated assembly or machine language programming. The new S'more BASIC Cartridge allows BASIC programmers to use over 60K of RAM for BASIC programs. This 57% gain in available memory is not restricted in any way, it can be used for arrays, variables and BASIC programs which would over-load the capacity of an un-expanded Commodore 64. List $69.95 **Sale $49.95**

S'MORE (for Super Memory Optimized RAM/ROM Expansion) is a powerful cartridge-based program which provides...

- 61,183 bytes of C-64 RAM memory freed for BASIC programming (57% more than the 38,911 now free). This gain is not restricted in any way, and can be used for arrays, variables, and BASIC programs which would overload the un-expanded C-64's capacity
- Over 60 new and enhanced BASIC commands & functions
- Full error trapping, and an automatic error help which lists the error line and places a flashing cursor at the beginning of the program statement containing the error
- No peeks or pokes because S'MORE provides direct access to normally peeked/poked items
- Full up-down scrolling through program listings for easier program editing

Relative File Commands: DOPEN# & RECORD #. **Print Using And Other Formatting Tools:** PRINT USING, PUDEF (define format for the PRINT USING function), & PRINT AT (row, col.). **Full Error Trapping:** TRAP, EL (returns error line #), ER (returns error #), ERR$ (returns error description), RESUME, & RESUME NEXT. **Structured Programming Commands:** DO, LOOP, EXIT, UNTIL, & WHILE. **Formatted Input Commands:** GETKEY, INLINE, INPUT (improved), INPUT AT (row, col.), INFORM (limits allowed response keys and length of response). **Peeks & Pokes Not Needed:** Direct access to normally peeked/poked items is provided with commands like BORDER, PAPER, INK, VID(x) (x—screen memory location), COL(x) (x—color memory location), VIC(x), SID(x), CIA(x), NORM, UPPER, & LOWER.

A BRIDGE TO THE C-128: Commodore 64 owners get immediate memory expansion from S'MORE. S'MORE's command structure is similar to the C-128, allowing programmers to make use of advanced programming techniques available on the C-128's new BASIC 7.0 so that programs written on S'MORE BASIC may be more easily converted to run on the C-128.

Write Now! — Word Processor Sale $34.95

Easy To Use Cartridge Based Word Processor for the C-64, With Full 80 Column On-Screen In Color View Mode

The WRITE NOW! word processor provides you with the easiest to use, fastest to learn format available for your Commodore 64 computer. It will give you all the fetures you would expect in a professional word processor and some features not found in any other Commodore 64 word processor.
(Cartridge) List $49.95. **Sale $34.95.** *Coupon $29.95.*

- Program is on cartridge and loads instantly so there is no waste of time loading from unreliable tapes or disks.
- Built in 80 column display allows you to see exactly what you will print including headers, footers, justification, page numbers and page breaks.
- Can send all special codes to any printer, even in the middle of a line without losing proper justification.
- Page numbering in standard numbers or upper or lower case Roman numerals.
- Full string search and search/replace functions.
- Direct unlimited use of previously stored text from tape or disk called from within text during the print out so it uses no memory space and allows creation of unlimited length documents.
- Full scrolling up and down through text.
- No complicated editing modes or commands.
- Multiple line headers and footers.
- Justification and text centering.
- Block copy and delete commands.
- Save text to tape or disk.
- Easy full screen editing.
- Works with any printer.
- Easy to understand instruction booklet.
- 4 help screens included.

Spell Now — Spell Checker Sale $19.95

"Spell Now" is a disk based professional spelling checker that interfaces with the "Write Now" word processor for the C-64. Use "Spell Now" to check the spelling in your "Write Now" files. It includes all features of the most expensive spelling checkers on the market. (Disk) List $39.95. **Sale $19.95.**

Graph Now / Paint Now — Graphic/Logo Generator Sale $19.95

A full graphics package capable of generating line, bar graphs and graphic art designs such as logos and pictures to be used with "Write Now" for the C-64. Save your graph or logo in a "Write Now" compatible file and print it out along with your "Write Now" text file. (Disk) List $39.95. **Sale $19.95.**

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PLUS All Atari Machines

Coin Controls 5000

Rated No. 1

Unconditional 2 Year Warranty

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5200 Joystick
Allows keypad hook-up
List $29.95 **Sale $24.95**

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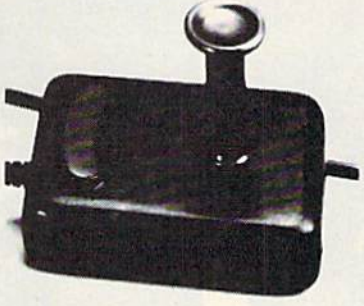
"Three Way Firing" Options

*Single Button Economy Model



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DLM

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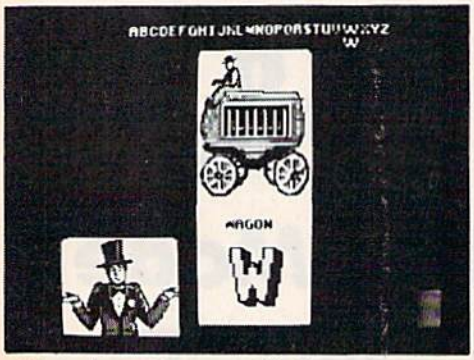
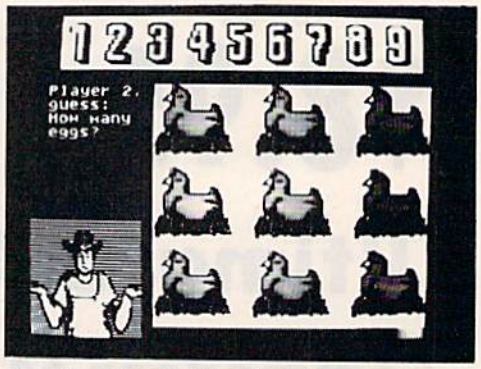
Makes your Computer into a Fun Classroom



Alphabet Circus. All the color and excitement of the big top are here, along with play-and-learn activities that enhance letter recognition, alphabet order, and text creation. The six games for one or two players are: Alphabet Circus, Meet the Circus, Alphabet Parade, Secret Letter, Juggler, and Marquee Maker. (Disk) List $29.95. **Sale $17.95.**

Spelling Wiz. A colorful wizard who uses his magic wand to zap missing letters into words, assists players in spelling more than 300 words commonly misspelled. (Disk)
List $34.00. **Sale $19.95.**



Number Farm. Here's a bumper crop of activities design to develop recognition of numbers and number words and an understanding of the concept of numbers. The six games for one or two players are: Number Farm, Old McDonald, Hen House, Animal Quackers, Horseshoes, and Crop Count. (Disk)
List $29.95. **Sale $17.95.**

Commodore 64 Sale

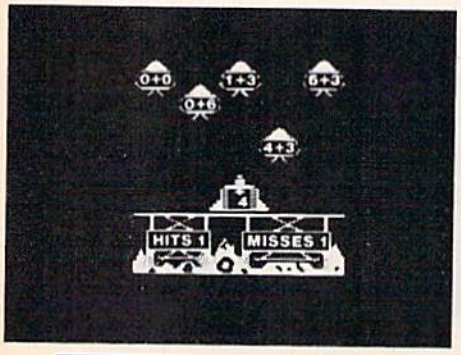
Alien Addition. The fast action and colorful graphics of arcade games motivate players of all ages to learn fundamental math skills. Alien addition provides practice in basic addition facts using an "Alien invasion" theme complete with spaceships and laser cannons. (Disk)
List $34.00. **Sale $19.95.**

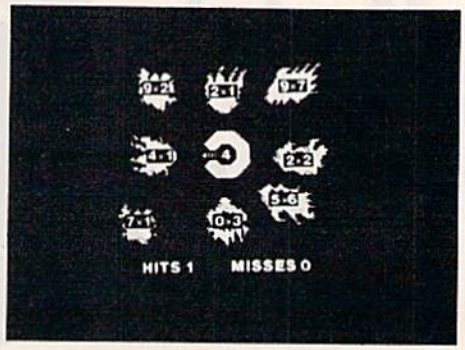
$17.95 - $19.95
Early Christmas Sale

Alligator Mix. Players build skills in addition and subtraction as they feed hungry alligators. Very challenging, with great graphics. (Disk)
List $34.00. **Sale $19.95.**

Commodore 64 Sale

Meteor Multiplication. Have fun blasting meteors, while learning basic multiplication facts. Requires motivation as players practice and are drilled in multiplication skills. Fast action and colorful graphics keep interest of all ages. (Disk)
List $34.00. **Sale $19.95.**





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Commodore 64

Computer Learning Pad

- **Makes Graphic Tablets Obsolete**
- **Includes Special Printer Feature**

Hi-Resolution!

Sale! $37.95

Now you get this **Fantastic Tech Sketch Computer Light Pen Program** with a **Professional Light Pen Free!** ($39.95 value) plus the **Micro Illustrated Graphics Pen Program** that allows you to draw on your T.V. or monitor screen (better than Gibsons $99 light pen). Whatever you can draw on the screen you can print on your printer (A Tech Sketch Exclusive.) (Disk) List $59.95 **Sale $37.95.**

Also available is **Lite Sprite**, a light pen driven sprite builder (List $39.95 **Sale $29.95**).

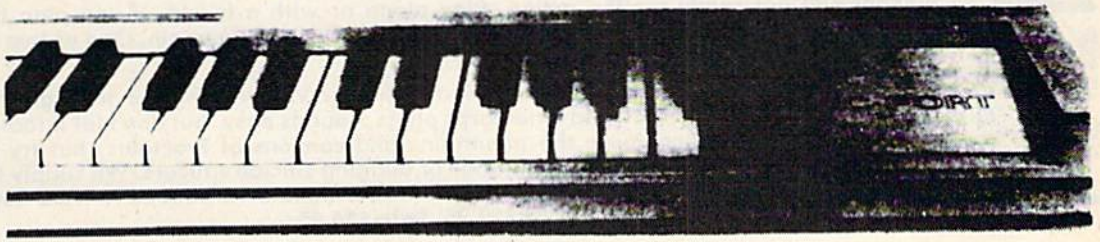
MUSIC PORT

The ultimate music synthesizer and multi-track recording system for the Commodore 64. A **Full-sized REAL Keyboard** and all software including preprogrammed songs are included. (Disk) List $149.95 **Sale $99.00.**

Fully Responsive "MUSICIANS" Keyboard

Sale! $99.00

No Extra Software Required



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Winter Games — Experience the challenge of six winter sporting events. In the Bobsled, you're right in the tube careening along the walls. At the SkiJump, you control your form in take-off, flight and landing. In Figure Skating, timing counts for the transitions, the jumps and landings. Choreograph your own routine in Free Style Skating. Hot Dog Aerials push your agility to new heights. The Biathlon challenges your endurance in cross-country skiing. There's even an opening ceremony, complete with national anthems. One to Eight Players. (Disk) List $39.95. **Sale $22.95.**

The World's Greatest Football Game — This one has it all — strategy, action, three views of the field. It's in a class all its own! Finally, a football game that not only puts you on the field, but also on the sidelines in the coach's shoes. Use the "Playbook" or design your own offensive and defensive plays. Then, grab the joystick and put your strategy to the test. You control key players to run a sweep, make a tackle, throw a pass and even kick a fieldgoal. All the action and all the strategy make this your favorite football game. (Disk) List $39.95. **Sale $22.95.**

Jet Combat Simulation. Flight simulation programs are the most requested in the country. The key to a good one is realism, the sensation of being in the cockpit — guiding the plane through take-offs, landings and air to air — air to ground combat. You are an Air Force pilot and your mission is critical. Your success in completing your orders depends on how quickly and accurately you react. Very Intense — Fantastic Graphics, animation and control elements. (Disk) List $39.95. **Sale $22.95.**

Barbie — The biggest name in dolls. Browse through Barbie's closet full of beautiful clothing and dress her for the party. You can cut her hair or make it longer and color it or change the style. Buy new clothing at the boutique or any of the six other specialty shops, or even go to the dress shop and create Barbie's designer clothes with the help of the computer. The combinations are endless and so is the fun. One or two players. (Disk) List $39.95. **Sale $24.95.**

Ballblazer — Unique split-screen, 3-D graphics give you and your opponent a first person view of the field of play. You race across the playfield in your Rotofoil trying to capture the ball and fire it through the goal before your opponent. The winner is the player with the most points at the end of the timed competition. Hold onto your joystick and keep that finger on the fire button, this is the type of two player head-to-head action you've been waiting for. Two Players. (Disk) List $29.95. **Sale $24.95.**

Summer Games II — The original Summer Games was last Summer's No. 1 seller. Carry on the tradition with another chance to "Go for the Gold!" Introducing Summer Games II with 8 new Olympic events including Kayaking, cycling, fencing, diving, track & field, gymnastics and equastrian. The excitement of Olympic competion is present in this new version as it was in the original. Great graphics and sound effects. This one's a winner! (1 to 8 players). (Disk) List $39.95. **Sale $24.95.**

G.I. Joe — The best selling toy soldier is now available as an activity toy on the home computer. Select the battle situation then choose the equipment you think you will need to get the job done. Choose from a number of uniforms and weapons in your well stock arsenal and get ready for the action. Play alone or with a friend, if you plan the right strategy you will complete the mission if not you will have to try again. One or two players. (Disk) List $39.95. **Sale $24.95.**

Rescue On Fractalus! — Your mission is to fly your Valkyrie Fighter through the Jaggi defenses and rescue the downed Ethercorps pilots. Sounds easy, but don't let it fool you. It's tough enough just to navigate the mountains and canyons of Fractalus, but try doing it while destroying enemy gun emplacements or dodging suicide saucers. We supply the Long Range Scanner, Dirac Mirror Shield and Anti-Matter Bubble Torpedoes ... YOU supply the skill and guts! One Player. (Disk) List $29.95. **Sale $24.95.**

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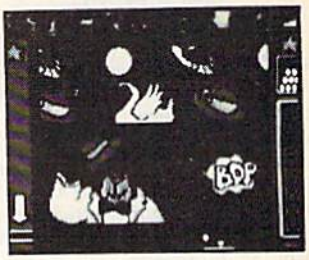
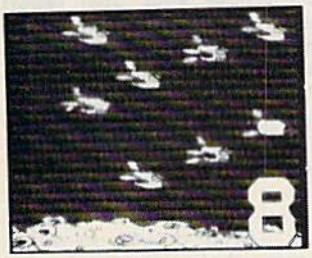
XEROX Educational Programs

Stickybear Bop



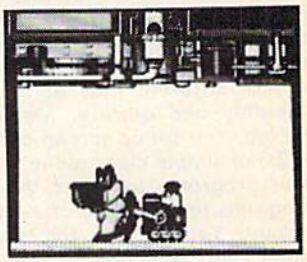
Rack up points by bopping all kinds of objects — planets, stars, ducks, and more... First, you'll flip balls at an animated shooting gallery of whizzing targets that appear. Bop as many as you can. Bop more, score more!... To pile up points in succeeding rounds, you must bop the assorted objects Mr. and Mrs. Stickybear are juggling...don't get bopped by the sandbags Stickybear drops when he sails across the top of the screen in his balloon... and watch out for a pair of silly birds who will try to steal the little balls you need to play with. The game continues with more shooting galleries, sandbags, a bigger flock of silly birds, and more of everything to be bopped. (Disk) List $34.95. **Sale $24.95.**



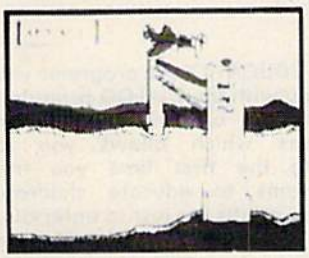
Stickybear Numbers

There are colorful groups of big moving objects, such as ducks, birds and bears, that reinforce numbers and counting skills. You can use the space bar to learn to count up and down. The many possible picture combinations work to captivate youngsters with an endless variety of picture shows and give them plenty of hands on computer experience. (32 page book, disk, colorful Stickybear poster, Stickybear stickers.) (Disk) List $34.95. **Sale $24.95.**

Stickybear Basketbounce



Your goal is to win as many points as you can by catching colorful, bouncing, falling objects — including bricks, donuts, and stars — before running out of baskets. While trying to accumulate points, Stickybear must duck falling objects and dodge moving ground obstacles that try to trip you. Keep score on the computer to see which player's on top.
New obstacles and falling objects in each successive round require more and more skill in order to score. The rounds increase in difficulty as you progress through each level, making Stickybear Basketbounce a game that is fun and challenging for all ages. (Disk) List $34.95. **Sale $24.95.**



Stickybear Opposites *Award Winner!*

Stickybear floats across the screen on unicycles, in cars, on hot air balloons and other delightful vehicles to teach beginners about opposites and build reasoning skills.
Such concepts as up/down, full/empty, in front/behind and more soon become crystal clear as Stickybear does his stuff with fun activities and eye-popping animation. A colorful book and a poster provide additional opposites for 3- to 6-year-olds to learn. (Disk) List $34.95. **Sale $24.95.**

Outstanding Software Award — Preschool Education — Creative Computing.

Stickybear ABC *Award Winner!*

Beautifully animated pictures help children learn their ABC's and become familiar with computers. Two full-screen, full-color pictures with sound represent each letter in the alphabet.
Besides helping boys and girls become familiar with computers, Stickybear ABC teaches younger children to recognize and name the letters. Older children begin to recognize words on sight. (Disk) List $34.95. **Sale $24.95.**

Best Software of the Year — Learning Magazine Parents' Choice Award — Parents' Choice.

Stickybear Shapes

Three delightful, full-color games help 3- to 6-year-olds identify circles, squares, triangles, rectangles and diamonds. When the youngster makes a correct choice, a big, bright picture comes alive with colorful animation! Even older children who have already learned these shapes will enjoy experimenting with Stickybear Shapes!
A special book and poster that accompany the disk provide additional activities for building shapes recognition, an essential school skill. (Disk) List $34.95. **Sale $24.95.**

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ReportWriter — Lets you make 'data' into information that can be reorganized and presented to help you make decisions. You need invoices turned into commission reports, customer leads tuned into mailing labels, accounts receivable turned into letters to your customers. ReportWriter can handle all of these requests. You create your own report ideas with ReportWriter. A report can be simple columns of figures, a memo, a check, a label, whatever you need. You may create as many reports as you like from the same files; it will report to the computer screen or to your printer. (Disk) List $39.95. **Sale $29.95.** *Coupon $24.95.*

MenuWriter — MenuWriter links programs together so the user can select the program he needs by pressing just one key. Where good program design calls for several different files or reports to load smoothly and quickly, MenuWriter does the job. You set up screen after screen (up to 21) of simple clear menu formats to link your programs together. Menus can call programs to auto-load or simply call other menus. You control the whole process -from color selection to screen layout, to key choice. Whether you're working with CodeWriter programs or your own, MenuWriter will give you professional menu results the first time. (Disk) List $39.95. **Sale $29.95.** *Coupon $24.95.*

SpeedWriter — What do you do with a BASIC program that you wrote (or bought, or typed) that is nice, does what you wanted it to do, but is just too slow to suit your needs? SpeedWriter makes BASIC FLY! A must for the sophisticated programmer, yet easy enough for the novice. Reduces program size up to 50%, in addition to speeding up your program to run 10-30 times faster. Couldn't be simpler! (Disk) List $49.95. **Sale $39.95.** *Coupon $34.95.*

Dialog — You can create all the EDUCATIONAL programs you can imagine without programming with the DIALOG program. Dialog is a simple on-screen process which allows you to create the first time you try, programs to educate children, inform adults, or just to entertain. Everything from simple tests to training manuals to complete novels. You control all the text, questions and answers. Any presentation is made more alive with the human give and take of real questions and answers. The Dialog system writes all the computer code onto your disk -to distribute any way to like. Graphics included. (Disk) List $49.95. **Sale $39.95.** *Coupon $34.95*

AdventureWriter — You think playing computer adventure games is exciting? How about the thrill of creating your own? It's all in this package. Your own heroes and villians, monsters and magicians, castles and coffins. You create complete adventure games without programming, which run on your disks. As many adventures as you can dream up - your treasures, your own fiendish riddles, and your treache rous plots for your friends to figure out! You control locations, treasures, hazards, characters, all descriptions and the plot. Computer adventures are one of the fastest growing hobbies around. Send them in for evaluation, we could market them for you. * graphics included in Commodore. **Com-64 Version** (Disk) List $49.95. **Sale $39.95.** *Coupon $34.95.* **Atari Version** (Disk) List $39.95. **Sale $29.95.**

ELF System — Finally, a simple way to create calculation/print programs. These are NON-FILE programs which let you: (A) Collect information; (B) Number crunch with all the conditional calculations you need; (C) Display the results to the screen or printer any way you'd like. It's like a spreadsheet without rows and columns an a super calculating word processor without the hassle. (Disk) List $39.95. **Sale $29.95.** *Coupon $24.95.*

Programming Made Easy

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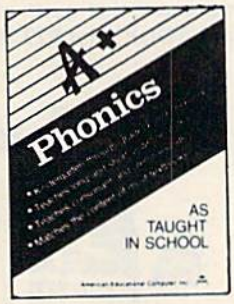
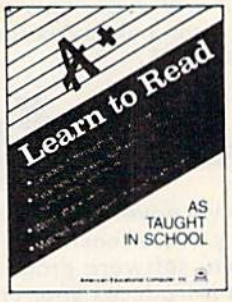
Atari & Commodore 64

EasyReader Series

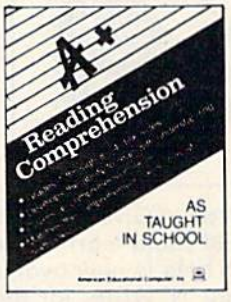
There are three programs in this series designed and tested by teachers from the appropriate grade levels for accurate content. Each disk keeps track of the students name, ensuring that the user completes one lesson before starting a new one. Animation, Graphics and sound are used in a successful way that keeps the child's interest as he learns each new skill. Correct answers are rewarded and wrong answers are corrected. Very easy to use, with most instructions appearing on the screen when needed.



Phonics. A program designed to teach beginning phonics: the sound of vowels and consonants. Helps child to develop skills for successful reading. The material covered follows the same guidelines of most textbooks. 8 disk sides; for Kindergarten through grade 4. (Disk)
List $39.95. **Sale $24.95.**



Learn To Read. Provides work with structural word skills — contractions, prefixes, suffixes, synonyms and more. Prepares child for material that will be covered in the classroom as well as building on traditional school curriculum. Grades 1-4. (Disk) List $39.95. **Sale $24.95.**



Reading Comprehension. Helps child to develop reading skills with an accent on understanding the material presented. Teaches cause and effect, similarities and differences, predicting outcomes, main ideas and more. Grades 1-8. (Disk)
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Atari & Commodore 64

(Disk)

AEC Spelling — A series of seven educational software programs for grades 2 through 8. It teaches the spelling of 4,000 words most commonly used in writing (98% of most people's writing vocabulary). The word lists used are the result of over 25 years of research into the writing/spelling needs of children and adults. Each grade level consists of one two-sided disk with word lists on one side and study activities on the other. The activities are designed to develop mastery in spelling utilizing a Test/Teach/Test approach. A pre-test is used to find out which words a user cannot spell correctly. These are recorded on a "Words To Study" list. The activities for learning these words are provided. Finally, a post-test is taken by the learner to measure progress. The approach is simple and rewards are built in. (Grades 1-8) List $39.95. **Special Sale — 8 programs/4 disks $24.95.**

(Disk)

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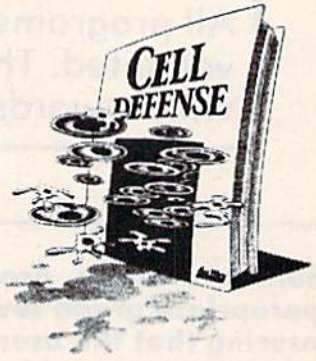

Cell Defense — Quick. Deadly viruses are rapidly multiplying. If you don't act fast, they'll infiltrate your entire bloodstream. And in seconds it'll be over. So blast the invaders with interferon. And annihilate them with macrophages. With Cell Defense, you control your own immune system. You'll discover basic concepts in biology. And explore exciting scientific strategies. While at the same time, leading an attack against a host of deadly viruses. So get yourself the science simulation game Cell Defense. Your life may depend on it. (Disk) List $34.95. **Early Christmas Sale $9.95.**

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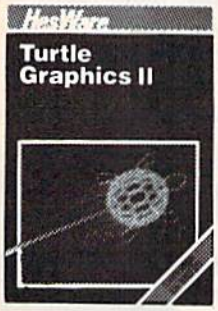
Super Zaxxon — Use the skills and tactics you learned in Zaxxon to master the new patterns and dangers in Super Zaxxon. Floating foretresses but with deadlier weapons and tighter passageways. 3-dimensional perspective but with even more realistic graphics. 3-dimensional flight but with a perilous tunnel requiring even more precise control. And a fire-breathing dragon that makes Zaxxon's robot look like a wimp. (Disk) List $29.95. **Early Christmas Sale $9.95.**

Early

Typing Tutor — Give your children an education they'll never get in school. Just think how much a child could learn if they had their very own private teacher at home. That kind of specialized help is now available through educational software programs from HesWare. There's Type 'N' Write, for the Commodore 64, that introduces your children to keyboard skills. Touch typing. And even word processing, for creating and editing up to eight pages. (Disk) List $29.95. **Early Christmas Sale $9.95.**

Christmas



Turtle Graphics II (LOGO) — An exciting and fun way to discover computer programming concepts. Turtle Graphics II is an easy-to-learn computer language that enables the beginning programmer to master the computer in just a few minutes. By telling an imaginary turtle how to roam about on the screen, the Turtle Graphics II programmer can create colorful and artistic pictures. As one becomes more and more adept at teaching the turtle to paint, he or she is painlessly learning all of the basics of computer programming. This not only develops computer awareness but enriches one's math, logic, communication and artistic skills as well. List $29.95. **Early Christmas Sale $9.95.**

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Broadsides — A tactical simulation of ship-to-ship combat between sailing ships of the Napoleonic era. You will match yourself against another ship commanded by the computer or by a human opponent. To be victorious you may use various types of ammunition for your cannons, or you may attempt to board the other ship and engage in close combat using swords and muskets. (Disk)
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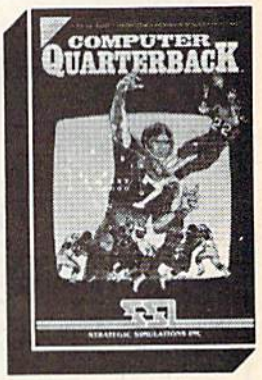
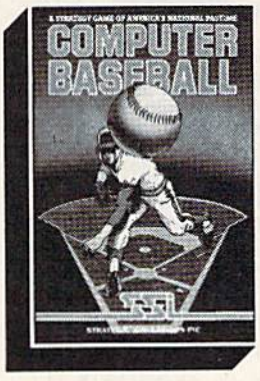
Computer Quarterback — This game offers true realism in a very playable format! Two players compete by selecting plays and then watching the animated action of their teams clash on the gridiron. The use of the game paddles allows each team to enter their plays in secret (as if in their respective huddles) until the offense "hikes" the ball. Fantastic Action. (Disk)
List $39.95. **Sale $24.95.**



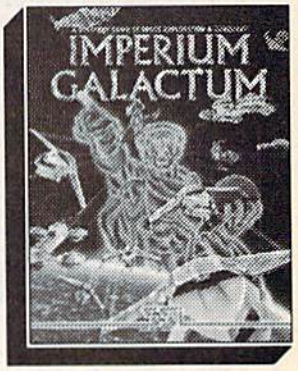
Field of Fire — World War II combat that allows you to direct fire, order assault and movement of fireteams on a scrolling hi-res. screen. Lead Easy Company of the First Infantry Division through eight historical battles in North Africa and Europe. (Disk).
List $39.95. **Sale $23.95.**

Computer Ambush — A simulation of squad versus squad (man to man) combat in France during World War II. Uncertainty factors are applied to all movement to create a realism unsurpassed by other wargames. By playing the game many times, you will begin to get a feel for what to expect, but you will never know for sure. Thus, we have here a game that truly creates the "fog or war". Fantastic Realism. (Disk) List $59.95. **Sale $39.95.**

Computer Baseball — Allows you to manage some of baseball's greatest teams, and make key managerial decisions yourself. Manipulate pinch hitters, infield positions, relief pitchers and base runners, trying to obtain that small statistical edge which can mean the difference between victory and defeat. (Disk)
List $39.95. **Sale $24.95.**



Imperium Galactum — You design your own legion of starships ranging from explorers to battleships. Your goal is to conquer a universe, a planet at a time, either by negotiating an alliance or in combat. Fantastic Graphics and Realistic Combat make this a must for everyone. (Disk). List $39.95. **Sale $26.95**



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Both the P-100 & P-150 Printers are fast and trouble-free! Both have memory buffers which allow data storage WHILE printer is running. Variety of fonts, long-life ribbon, crisp printing. With purchase, you get a TOLL-FREE phone number to call for useful tips and answers!

P-150 PRINTER It's even faster (150 CPS). Tractor feed. 2K data buffer (Optional: expandable to 4K and/or 68K). Impact logic seeking printing. 50 yd. ribbon/10 million characters. Choose the P-150 for higher speed and capacity.

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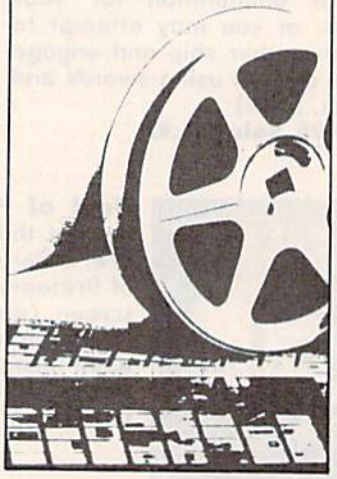

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also worth noting

Paperback Writer 64

There are a number of word processors for the 64 which are either too difficult for the occasional user or too simplistic for heavy users. *Paperback Writer 64* is in neither category. It's very easy to use, but includes many advanced features as well. Although the manual is thorough and well-written, you probably won't need to consult it very often: The program disk contains 38 different help screens. If you need guidance or have a problem, simply call up a help screen to get the information you need, then go right back to writing your document.

Another handy feature is the spelling checker, which automatically checks the spelling of every word in your document. The spelling checker builds up a dictionary on disk by reading words from your documents (so the more you use it, the more it knows). When it finds a word it doesn't know, you have the option of adding it to the dictionary as a new word or immediately correcting the misspelling in your document file.

Paperback Writer works with many popular printers and offers 40- or 80-column screen display. 80-column mode lets you see exactly what the finished document will look like as you type it. However, this mode is (unavoidably) slower than 40 columns, and while the 80-column display is acceptable with a monochrome monitor, it's somewhat hard to read on a Commodore monitor. The authors are aware of this and suggest writing in the fast 40-column mode, then previewing the document format in 80 columns before printing. A version for the Commodore 128 and 1541 disk drive is also available.

Digital Solutions, Inc.
P.O. Box 345, Stn 'A'
Willowdale, Ontario
Canada M2N 5S9
64 version $39.95 (disk)
128 version $49.95 (disk)

Super Bowl Sunday

If you're a pro football fan and have a 64, this game is a must for your software library. Included are 20 of the greatest all-time Super Bowl teams (optional season disks are available). Each team is a carefully detailed reproduction of the original team, with statistics defining the strengths and weaknesses of individual players. All 22 players are graphically displayed, and each is animated as the play begins. By selecting from dozens of available offensive and defensive formations via menus, you call the game. If you call a running play, you choose who carries the ball. If you suspect an end-run, you decide which linebacker blitzes. Statistics are available at all times to monitor player effectiveness in any situation.

Game play is realistic—offsetting penalties, timeouts, injuries, double-teaming receivers, fatigue factors, and so on—and up-to-the-minute individual team and game statistics are available at any time. *Super Bowl Sunday* also offers three modes of play: You can play against the computer or a human opponent, or sit back and watch the computer play against itself. (The latter mode is an interesting way to see which is really the best-ever Super Bowl team.) *Super Bowl Sunday* is a feature-laden, yet easy-to-play game that will please even the most avid pro football fan.

The Avalon Hill Game Company
4517 Hartford Rd.
Baltimore, MD 21214
$30 (disk)

Phantasie

SSI has created an excellent fantasy role-playing game which should keep you glued to your 64 for a long time. Very much in the tradition of the best of this kind of adventure game, *Phantasie* lets you put together a band of adventurers to search the Isle of Gelnor. Overcoming the Black Knights and their leader, the Dark Lord, is your quest. You'll need to choose your band of heroes well, since interaction among them is crucial to your success. The game employs a vertical split screen approach, showing you both the area in which you're traveling and the party of adventurers. You'll battle monsters, collect treasure, wield magic, and explore wilderness and dark dungeons. The graphics are excellent, and playability is one of the game's strongest features. If you're just getting started with adventure gaming, this is a very good first choice. If you're experienced, you'll appreciate all of the attention to detail.

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USR Joystick Reader

Tim Gerchmez

Programming the joystick in BASIC may give disappointing results. It's just too slow. This program offers the speed of machine language for use in BASIC programs. For the 64 and VIC-20.

One of the most important decisions a computer manufacturer makes when designing a new computer is how many features to include. The more features, the higher the cost. In order to keep the price of the VIC and 64 competitive while still maintaining superior sound and graphics, Commodore decided to take a few shortcuts with the BASIC language. Simply reading the joystick, for example, requires a complex series of POKEs and PEEKs. It's not only complicated but also slow.

"USR Joystick Reader" makes reading a joystick quicker and easier. It employs the USR function to simulate the JOY function found in the much larger versions of BASIC included with the Plus/4, 16, and 128.

The Mysterious USR

USR (which stands for *user*) is not a fitting name for this function. It's hardly *used* at all because most people don't know how to make it work or what it does.

USR is like a cross between SYS and FN. Instead of defining the function in BASIC using the DEF FN statement, the function is written in machine language (ML). First, you either POKE or load the ML into memory. Then you tell the computer where your ML routine is by POKEing locations 785 and 786 (locations 1 and 2 on the VIC) with the low- and high-byte of the starting address.

Now that you've defined the function, you're ready to put USR in your BASIC program. As with FN, USR is followed by a numeric expression in parentheses. It can be a number as in USR(6), a variable like USR(X), or a complex expression such as USR(PEEK(X)+256*PEEK(X+1)). When the USR function is executed, the computer evaluates the expression in parentheses and puts that value into floating-point accumulator 1 (FAC1). (For more information on FAC1 and USR, refer to *Programming the 64* or *Programming the VIC*, published by COMPUTE! Books.)

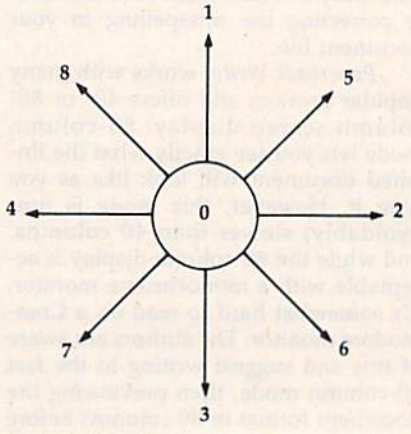
It then executes your ML routine, which takes the floating point number in FAC1, processes it in some manner, and stores the result back into FAC1. If you end your routine with an RTS instruction, the computer returns to BASIC and makes USR equal to the new value in FAC1. USR can then be treated like any other value as in Y=USR(X) or PRINT USR(3).

USR is easier to use than SYS because you can pass values between BASIC and ML and you don't have to specify an address. It's faster than FN because the function is defined in ML. But it's more difficult to set up than either one.

Putting USR To Work

Fortunately, you don't have to know anything about USR to add USR Joystick Reader to your own programs. Just type in the appropriate version for your computer and save it on tape or disk. Now type RUN. The program is a BASIC loader which POKEs an ML joystick reader into memory and points the USR vector to it. If "DATA ERROR" is displayed, you've made a typing error in the DATA statements and you should correct your mistake and resave the program.

Now instead of typing a series of PEEKs and POKEs, just use A=USR(1) to read a joystick in port 1 or A=USR(2) to read port 2 (since the VIC has only one joystick port, use A=USR(1) only). The value of A will be a number from 1 to 8 corresponding to the eight directions and 0 if the joystick is in the center position (see the figure). To read the fire button, use B=USR(3) for port 1 or B=USR(4) for port 2 (on the VIC, B=USR(2) only). The value of B will be 1 if the button is pressed, and 0 if it's not.



Joystick directions

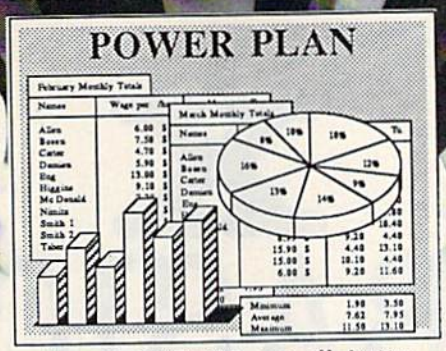
To use USR Joystick Reader in your own program, include it at the beginning. You can add the following lines to the loader program to check if the joystick (port 1 on the 64) is pointing to the right:

```
200 A=USR(1):IF A=2 THEN PRINT
    "RIGHT"
220 GOTO 200
```

You can also check for the fire button by adding this line (on the VIC, use USR(2)):

```
210 B=USR(3):IF B=1 THEN PRINT
    "FIRE"
```

See program listings on page 126.



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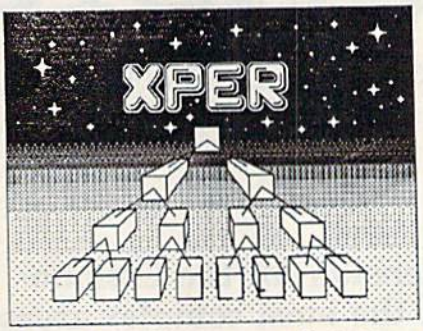

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X BASIC

Kevin Martin, Editorial Programmer

This powerful BASIC extension for the Commodore 64 focuses on two of the most complex areas to program: graphics and sound. With 33 new commands, it offers control of high-resolution screens, character and screen display functions, sprites, and sound.

Two of the most complex and tedious areas of programming on the 64 are graphics and sound. Even some of the most elementary graphics and sound routines require a lot of programming time and long strings of POKEs. "X BASIC" (eXtended BASIC) is a programmer's language that does much of the difficult programming for you, allowing you more time to design and experiment.

Written entirely in machine language, X BASIC adds 33 graphics and sound commands to BASIC: 7 commands for hi-res; 7 for screen and character functions; 6 for sprite creation and manipulation; 10 for sound; 2 for joystick control; and 1 for exiting the program.

Typing Instructions

X BASIC is written entirely in machine language and requires "MLX" to type in. MLX appears frequently in COMPUTE!'s GAZETTE. After loading MLX, run it. When prompted for the starting and ending addresses, enter **49152** and **52073,** respectively, then enter X BASIC. When finished typing in the program, save a copy. To load X BASIC, type **LOAD** *"filename"*,**8,1** (disk) or **LOAD** *"filename"*,**1,1** (tape). To activate it, type **SYS 49152.**

All commands can be used in direct mode as well as program mode. Some commands need to be followed by one or more parameters consisting of numbers or strings. The parameters can be variables (X or N$) or actual values (5 or "HELLO"). Numeric parameters must be within a specified range. Attempting to use a number that's outside the range of legal values results in an ILLEGAL QUANTITY error. Also, if you try to use a number for a parameter which requires a string, or vice versa, you'll receive a TYPE MISMATCH ERROR. *(Note: All X BASIC commands are in boldface capital letters. Command parameters follow in boldface lowercase letters.)*

Hi-Res Graphics Commands

HIRES: Turns on the hi-res screen and sets it to multicolor mode. (All hi-res graphics in X BASIC are set up for multicolor mode.) The hi-res screen is located underneath the Kernal ROM starting at $E000. You can POKE directly to the screen, but you can't PEEK the screen unless you switch out the Kernal.

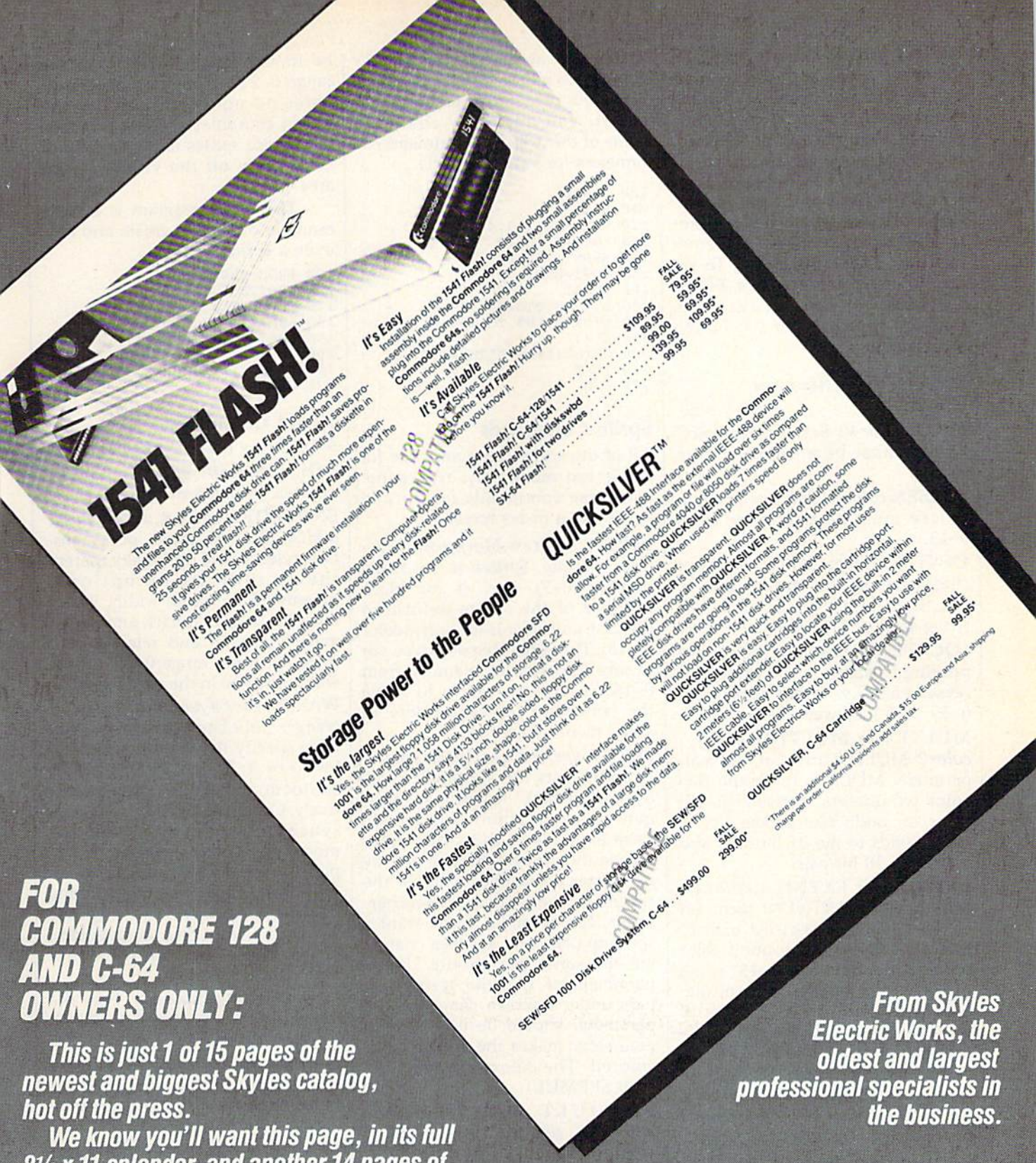
TEXT: Returns to normal text mode. *Always use TEXT to go from hi-res mode to normal display. Do not exit hi-res with RUN/STOP-RESTORE.*

CLEAR *color0,color1,color2,color3*: Clears the hi-res screen and lets you choose the colors for plotting. *Color0* corresponds to the 01 bit pair, *color1* the 10 bit pair, and *color2* the 11 bit pair. *Color3* is the background color. The values for the colors correspond to the POKE values in the range 0–15.

COLR *color#*: Selects the color for the PLOT and LINE commands on the hi-res screen. Its parameter allows you to select one of the four colors (0–3) defined by the CLEAR command.

PLOT *x,y*: Plots a point on the hi-res screen in the current color. If the color is 3 (the background color), it effectively erases a point. The x-coordinate is the distance from the left edge of the screen and ranges between 0–159. The y-coordinate is the distance from the top of the screen between 0–199.

LINE *x1,y1* **TO** *x2,y2*: Draws a line between *x1,y1* and *x2,y2* in the current color (or erases like PLOT). The x-coordinates range between 0–159, the y-coordinates between 0–199.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HPRNT *string*: Prints a string on the hi-res screen at the location set by LOCATE (see below). When the hi-res screen is in multicolor mode, the characters will appear distorted. Multicolor mode can be turned off with the MULTI 0 command. HPRNT defaults to the uppercase/graphics character set. If you'd prefer the upper/lowercase set, enter this line: **POKE 50819,216**. To return to uppercase/graphics, **POKE 50819,208**. You can mix characters from the two character sets on the same screen.

Screen And Character Commands

BRDR *color#*: Sets border color. *Color#* must be a number from 0–15.

SCREEN *color#*: Sets screen color. *Color#* must be a number from 0–15.

CENTER *string*: Centers a string of characters on the current line of text, then prints a RETURN. *The string must be 1–38 characters long.*

LOCATE *x,y*: Positions the current printing location on the text or hi-res screen to x,y. *X* must be between 0–39, and *Y* between 0–24.

MULTI 0 or **MULTI 1,*color1*, *color2*:** MULTI 0 turns off multicolor mode. MULTI 1 (with the two color parameters, between 0–15) turns on multicolor mode. *Color1* corresponds to the 01 bit pair, and *color2* the 10 bit pair.

EXTND 0 or **EXTND 1,*color1*, *color2,color3*:** EXTND 0 turns off extended background mode. EXTND 1 (with background color parameters, between 0–15) turns on extended background mode. Characters with a POKE value of 64–127 use *color1* for the background, characters 128–191 use *color2*, and characters 192–255 use *color3*. *Note: extended background color mode cannot be used when the hi-res screen is turned on.*

CSET *block*: Copies the uppercase character set from ROM to RAM at *block**1024. *Block* should be a number between 1–15. This command is handy when using custom characters. You may have to prevent BASIC and the character set from interfering with each other by moving the bottom (or top) of memory.

Here's a short program that demonstrates the use of some of the hi-res and screen and character commands above. After X BASIC is activated, type in this program and run it. You might try changing some of the X BASIC command parameters for various effects.

```
100 BRDRØ
110 HIRES
120 CLEAR 1,2,3,4
130 LOCATE 10,10
140 HPRNT "HELLO"
150 FORI=ØTO3
160 COLRI
170 LINE Ø,ØTO159,159
180 LINE Ø,199 TO 159,Ø
190 NEXT
200 GETA$:IFA$=""THEN150
210 TEXT
220 END
```

Sprite Commands

All of the sprite commands are for use in text mode only. You cannot use these commands for putting sprites on a hi-res screen.

SPRITE *sprite#,block,color*: Defines a sprite. *Sprite#* is the sprite number (0–7), *block* is the block number of the sprite definition (0–255), and *color* is the sprite color (0–15). The sprite shapes can be put in any free area of memory from 0–16383. You may have to move the bottom or top of memory to avoid memory conflicts.

SPRAT *sprite#,xexp,yexp,priority,multi*: Sets the sprite attributes (characteristics). To turn an attribute on, use 1; to turn it off, use 0. *Xexp* expands in the x-direction, *yexp* in the y-direction. The *priority* parameter determines whether the sprite has priority over screen characters. For example, if you want a sprite to pass over a screen character, the sprite has priority, thus a parameter of 1. If the sprite is to pass under a screen character, the parameter should be 0. *The multi* parameter makes the sprite multicolored. The colors are specified with SPRMULT.

SPRMULT *color1,color2*: *SPRMULT* sets the two additional sprite colors used in multicolor mode. The parameters must be within 0–15.

ASPRITE *sprite#*: Activates a sprite. *Sprite#* must be 0–7.

DSPRITE *sprite#*: Deactivates a sprite. *Sprite#* must be 0–7.

MOVE *sprite#,x,y*: Moves a sprite to the coordinates (x,y), based on the upper lefthand corner of the sprite. *Sprite#* must be 0–7. *X* must be in the range 0–511, *y* in the range 0–255. Note that the coordinates do not correspond to the screen coordinates; some locations may cause sprites to be partially or completely off the visible screen area.

This short program is a basic example of how to create and animate a sprite:

```
100 BRDR Ø:SCREEN 11
110 SPRITE 1,123,7
120 SPRMULT 1,3
130 ASPRITE 1
140 FORJ=ØTO1:SPRAT 1,J,J,J,J
150 FORI=ØTO350
160 MOVE 1,I,100
170 NEXTI,J
```

Sound Commands

SID: Clears the SID (sound) chip.

VOL *volume#*: Sets the volume register. *Volume#* must be 0–15.

ENVELOPE *voice#,ad,sr(,pulse width)*: Sets the attack, decay, sustain, release, and optionally (parentheses indicate an optional parameter) the pulse width. *Voice#* must be 1–3. *Ad* (attack and decay) and *sr* (sustain and release) each must be in the range 0–255. Pulse width must be in the range 0–4095.

WAVE *voice#,waveform(sync)(ring)*: Sets the waveform. You must specify the voice number followed by T, S, P, or N for triangle, sawtooth, pulse, and noise, respectively. Optionally, you can add *s* for synchronization, and *r* for ring modulation. Here are some examples: WAVE 1,TSR (triangle waveform with synchronization and ring modulation); WAVE 3,PR (pulse waveform with ring modulation); WAVE 2,SS (sawtooth waveform with synchronization).

FRQ *voice#,frequency*: Sets the frequency in the range 0–65535. *Voice#* must be 1–3.

GATE *voice#,on/off*: Gates a voice on or off. *Voice#* must be 1–3 followed by 0 to turn the gate bit off or 1 to turn it on.

The following sound commands deal only with filters. Some programmers may not be interested in these, but if you have a serious interest in 64 sound, you'll find these handy.

FCUT *cutoff*: Sets the cutoff frequency. *Cutoff* must be in the range 0–2047.

FRSN *resonance*: Sets the filter resonance. *Resonance* must be in the

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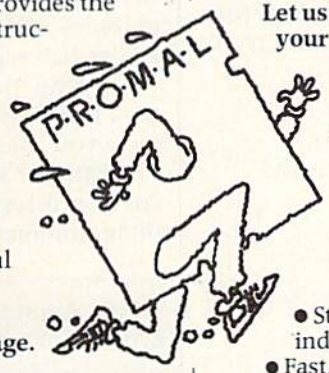

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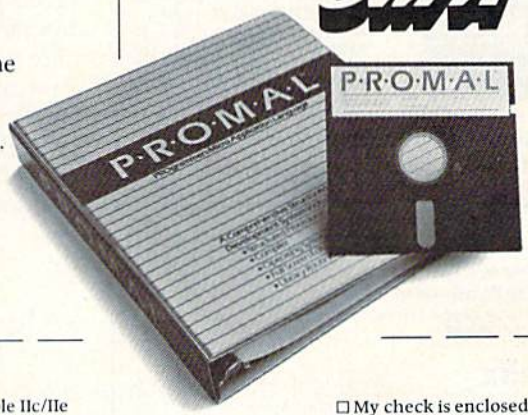

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range 0–15.

FMODE *type*: Selects the filter type. *Type* can be H for high band filters, L for low band, B for bandpass, or a combination of these. For example, FMODE HBL for all types; FMODE HL for high and low.

FILTER *voice#,on/off*: Turns the filter on or off. *Voice#* must be in the range 1–3 followed by 0 to turn off the filter or 1 to turn it on.

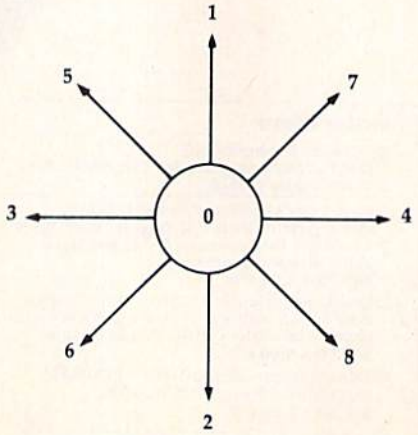
To demonstrate the sound commands, type in this program. By playing with the parameters, you can produce some most unusual effects.

```
100 SID
110 VOL 15
120 FORI=1TO3
130 ENVELOPE I,15,240,2000
140 FILTER I,1
150 NEXT
160 FRSN 15
170 FMODE H
180 WAVE 1,TSR
190 WAVE 2,SS
200 WAVE 3,P
210 GATE 1,1
220 GATE 2,1
230 GATE 3,1
240 FRQ 1,4000
250 FRQ 2,6000
260 FORI=100TO2000
270 FCUT I:FRQ 3,20000-I*10
280 NEXT
290 SID
```

Joystick Commands

The parameters for these commands require parentheses ( ). Note the examples in the descriptions below.

STICK *joystick#*: Reads the joystick direction. *Joystick#* must be 1 to read port 1, or 2 for port 2. This command returns a value in the range 0–8, so it must be used like a function (X=STICK(1), for example). Values 1–8 correspond to the eight possible directions as shown in the figure. The value is 0 if the joystick is centered.



BTN *joystick#*: Returns a value of 1 if the firebutton is pressed, or 0 if it's not. *Joystick#* must be 1 or 2. As with STICK, this command is a function. A good way to use it is within an IF-THEN statement (IF BTN(1)=1 THEN ...).

Reset Command

QUIT: Disengages X BASIC by resetting all vectors to normal.

Space doesn't permit a lengthy discussion of *how* to program graphics and sound on the 64. If you've had experience in these areas, you'll find this utility an efficient tool. If you're a beginning programmer, you may wish to consult the *Programmer's Reference Guide* for specific information on programming graphics and sound.

Quick Reference Chart for X BASIC Commands

Hi-Res Graphics Commands

HIRES
TEXT
CLEAR *color0,color1,color2,color3*
COLR *color#*
PLOT *x,y*
LINE *x1,y1* **TO** *x2,y2*
HPRNT *string*

Screen And Character Commands

BRDR *color#*
SCREEN *color#*
CENTER *string*
LOCATE *x,y*
MULTI 0 or **MULTI 1**,*color1,color2*
EXTND 0 or **EXTND 1**,*color1,color2,color3*
CSET *block*

Sprite Commands

SPRITE *sprite#,block,color*
SPRAT *sprite#,xexp,yexp,priority,multi*
SPRMULT *color1,color2*
ASPRITE *sprite#*
DSPRITE *sprite#*
MOVE *sprite#,x,y*

Sound Commands

SID
VOL *volume#*
ENVELOPE *voice#,ad,sr(,pulse width)*
WAVE *voice#,waveform(sync)(ring)*
FRQ *voice#,frequency*
GATE *voice#,on/off*
FCUT *cutoff*
FRSN *resonance*
FMODE *type*
FILTER *voice#,on/off*

Joystick Commands

STICK *joystick#*
BTN *joystick#*
(joystick#'s **must be in parentheses)**

Reset Command

QUIT

See program listing on page 136.

C: Language Of The Future ?

Charles Brannon
Program Editor

Although C has been a popular mainframe and minicomputer programming language for several years, it is now perceived as a hot new language, demanding attention as a unique programming tool for microcomputers. It's used as the primary language for applications programmers on the IBM PC, Apple Macintosh, Atari ST, and Commodore Amiga. C is faster and more flexible than BASIC. As better C compilers and interpreters are becoming available, some suspect that C could emerge as a new standard for microcomputers, toppling even the long reign of BASIC.

Unless you learn to program, your use of a computer will always be limited to entering or extracting information from "canned" applications software. Commercial software continues to become easier to use while growing more powerful and more flexible. But it's hard to trace your family tree with a database, plot a biorhythm with your graphing utility, or manage your paper route with a spreadsheet. Programmers are not limited by what programs they can buy, but are free to design their own custom applications.

By programming, you gain full control over your machine. The simplest computer is a far more powerful tool in the hands of the programmer. Even beginning programmers have more control over their machines than the savviest dBASE users.

BASIC was designed especially for the beginner. The acronym (Beginner's All-purpose Symbolic Instruction Code) is a bit contrived, but the language is indeed easily picked up. There are about 50 commands to memorize, but you don't need to learn them all at once. Once you're able to break down your idea into a detailed recipe-like sequence of steps, you can translate these steps into BASIC instructions.

BASIC is built into or available for almost every computer, and is the most popular general-purpose programming language. However, BASIC does not meet everyone's needs. It's too slow for system functions, games, heavy number crunching, or intensive disk access. BASIC programs can be unbearably slow, though the language is fast enough for many applications.

Designed for the beginner, BASIC cramps the style of the more advanced programmer. Its archaic use of a line-number-based editor is one example; today's modern languages (including special versions of BASIC) use word-processor-style editors. GOTOs are replaced with structures like WHILE/WEND. Meaningless line-number references like GOSUB 10023 are replaced by meaningful statements like DISPLAY.SCORE.

Modern language concepts permit variables to be either specific to a subroutine or shared between all parts of a program. Also, some languages are extensible: New functions can be written in the language. Once you write a function, it can become a new word in the language, just like any command. Function libraries can be built up and programs designed by combining pretested routines.

Many of these beyond-BASIC languages, including Pascal, C, Ada, and Modula-2, are compiler languages. You lose some of the convenience of BASIC programming when using a compiler. You write your program in the editor, submit it to the compiler, wait for the program to compile, then link the compiled program with other subprograms and library routines to create a runnable program.

You have to go through the entire load editor/load program/edit program/save program/load compiler/compile program/load linker/link program/execute program sequence every time you want to correct and test even a trivial bug. This alone discourages many beginners from even trying to program in a compiled language. The interactive, forgiving environment of BASIC is better to learn with. However, there are C interpreters available for some machines. The interpreters are ideal for learning the language or interactively programming in C, although they're slower and may not permit all the options supported by a true compiler. However, once the program works, you can go through the formal compile/link process to produce a fast, efficient program module.

The primary advantage of a compiler is increased execution speed. Instead of an interpreter examining and translating each statement of a program while the program runs, a compiler converts the program to machine language all at once. For the computer, it's like the difference between understanding French by tediously translating it into English versus being born and raised in France.

A compiler/linker also facilitates the sharing of prewritten/pretested routines. Why constantly reinvent the wheel when you can pick and choose from a huge inventory of subprograms?

While BASIC, Pascal, and machine language have been vying for programmers' attention, C quietly sneaked in and took over applications programming in some environments. C was used to write a number of major software products, from *Lotus 1-2-3* to the AT&T Unix multitasking operating system for minicomputers. C represents an efficient mix of low-level, fast operations and high-level language constructs, such as arrays, record structures, and user-defined variable types.

C is also highly transportable, so you can write long, complex programs that will run fairly quickly on any other machine's C compiler. Programmers can develop on their favorite machine, then transport most of their code to another computer with few changes.

C is the inner language of the Amiga. In fact, much of the operating system and nearly all the Amiga applications are written in C. In practice, C is the machine language of the Amiga, with real machine language used only for speed-critical subroutines. The entire operating system is designed to interface with C, so, in effect, all of the Kernal is part of your language. C is amazingly fast on the Amiga, even with the advanced windowing and multitasking features.

C code is terser and harder to read than BASIC, but the compact style of the code makes the compiler's job simpler. C is designed around the concept of "smaller is better." It has only a handful of statements and operators, making it a tiny language, but the language is effectively extended by subroutines. For example, there are no input/output statements like PRINT built into C, but the *printf* function, which works something like PRINT USING, is always available in the standard library.

The best way to understand a language is to follow an example program. We'll assume that you're familiar with BASIC, so we'll compare a C program to the equivalent BASIC. The example is a simple bubble sort demo that scrambles a list of 100 numbers, then sorts it.

Both the BASIC and C programs are written in their respective styles. The BASIC is standard Commodore 64 BASIC. The C program was written with the *Super C Language Compiler* for the 64 from Abacus Software.

The C program is formatted with plenty of space to show nesting. It's broken up into small, individually testable modules. It uses long, meaningful variable names, and most commands are on a line of their own. Nothing prevents you from writing the program all mashed together as one huge program line, but since the compiler throws out spaces, there's no reason to compact a program to save memory or make it run faster. Most C programmers follow this "pretty-printing" style when programming. Some editors and compilers even insert the indentation for you.

The BASIC program is written compactly to conserve memory, which makes an interpreter run faster. Commodore BASIC does not safely permit long variable names or named subroutines, so GOSUB is needed. There is no repeat command, so GOTO is substituted. The BASIC program is harder to read. It could have been written with one statement per line with plenty of extraneous REMarks to identify the meaning of the GOSUBs, and with indenting. Few BASIC programmers do so.

Finally, some readers might conclude that the benchmark makes BASIC look bad or find the C code inefficient, but no benchmark can accurately compare such different languages. These programs are intended to be illustrative rather than ideal.

The C program starts out with commands preceded by #'s. These are commands to the compiler's *preprocessor*, not actual C commands. The *#include* command tells the compiler to include the library functions from a library "stdio" standard to all C languages. The standard input/output (stdio) library permits the use of *printf*. The *#define* commands effectively substitute the constant for the all-caps macro names. This is not the same as using a variable, since this substitution is done during the compilation, not during the program run. The #define's permit us to use meaningful constants without the speed or memory constraints of variables.

Line 5 of the C program is the equivalent of DIMensioning an integer array. The prefix *static* causes the array to be initialized to zero and *unsigned* makes the range of the integers from 0–65535 instead of from −32768–32767.

The *main()* loop is like a "wish list" of the program recipe. It does not perform the actual functions, but choreographs the execution of the program. The program flows like this: (1) Scramble the list; (2) Display the list to see that all the numbers are scrambled; (3) Sort the list; (4) Display the list to see that the list is sorted. Notice how each statement ends with a semicolon. Statements are not terminated at the end of a line as in BASIC, but only by semicolons. The semicolons let you write long, extended sections of code. Open and closed braces are used to define a block of code which will be seen as a single entity.

The function *scramble_list* defines a variable for its own use in line 14. Variables are defined as needed, then discarded after use, saving memory and preventing variable name conflicts between subroutines. You can also define variables to be global, available at all times to all parts of a program.

The C equivalent of FOR-NEXT includes the starting value of the index, the ending condition of the loop, and a statement to change the value of the index. The ++ operator increments the index through the loop. You could alternately multiply I by two, decrement it, change it from a list, skip by

four—whatever it takes to iterate your loop. Either a single statement or a block of code set off with braces can be repeated. The C FOR statement is more flexible than the simple BASIC counterpart.

We need to define our own random function, since C does not include one. The formula is straightforward with * for multiplication, + for addition, and % for modulo (the remainder after an integer division). As you can see, functions can live up to their name by returning a value. This is roughly like using DEF FN in BASIC.

The *display_list* function dumps the integer array to the screen. The *for* loop works the same as before, and the %u (unsigned display of an integer) option of *printf* displays our 16-bit integers without interpreting some numbers as negative. As you can see, the *printf* function works like the PRINT USING found in some BASICs.

The sorting program is completely parallel to the BASIC program. A bubble sort works by comparing adjacent items in a list, and switching the pair if they're out of order. By repeated passes through the list, the lower numbers are swapped towards the top of the list ("bubbling" to the top) while the higher numbers move toward the bottom of the list. When no pair has been exchanged after a pass through the list, we know the list is in order.

Our C bubble sort repeats the loop as long as the exchange flag is TRUE (nonzero). Each time we start a pass through the array, we set the exchange flag to FALSE. The indexed item and its successor are compared with the IF statement, which works similarly to BASIC's IF. Notice that == is used for a test for equality; the = symbol assigns values.

The C program took 1 minute and 35 seconds to sort the list (the time taken to scramble and display the list are not counted), with BASIC clocking in at 2 minutes even.

This is not the kind of difference in performance that makes you want to abandon BASIC and embrace C. However, with relatively simple changes, the sort module can sort any array of any size, making it a useful language command, not just a subroutine. The #define's let us easily change the size of the array throughout the program. In practice, C programmers first write their application in C and then replace time-critical sections with pure machine language, just as many BASIC programmers do.

Unless you're using C on other machines, it may not be worth your while to use C on the 64. However, using a C compiler on the 64 is a great way to learn C, to prepare yourself for programming another machine, like the Amiga. Also, the convenience of using an extensible, powerful language is more apparent when you design large, complex programs.

BASIC Version—Bubble Sort Demo

```
10 DIM L%(100)
20 GOSUB 100:GOSUB 200
30 PRINT:PRINT"SORTING...":GOSUB300
40 PRINT"FINISHED.":GOSUB 200
50 END
100 FORI=0TO99:L%(I)=32768*RND(1):NEXT:RETURN
200 FORI=0TO99:PRINTL%(I);:NEXT:PRINT:RETURN
300 EX=0:FORI=0TO98
310 IFL%(I)>L%(I+1)THENH=L%(I):L%(I)=L%(I+1):L%(I+1)=
    H:EX=1
320 NEXT:IFEX=1THEN300
330 RETURN
```

C Version—Bubble Sort Demo

```
 1 #include "stdio.c"
 2 #define SIZE 100
 3 #define TRUE 1
 4 #define FALSE 0
 5 static unsigned list[SIZE];
 6 main()
 7 {  scramble_list(); display_list();
 8    printf("\nSorting...\n");
 9    sort_list();
10    printf("\nFinished.\n");
11    display_list();
12 }
13 scramble_list()
14 { int i;
15   for (i=0;i<SIZE;i++) list[i]=rnd();
16 }
17 int rnd()
18 {  static unsigned seed=1;
19    return seed=(seed*257+31415)%65536;
20 }
21 display_list()
22 {  int i;
23    for (i=0;i<SIZE;i++) printf("%u ",list[i]);
24 }
25 sort_list()
26 { int i,exchanged,hold;
27   do
28   { exchanged=FALSE;
29     for (i=0;i<SIZE-1;i++)
30     { if (list[i]>list[i+1])
31       { hold=list[i];
32         list[i]=list[i+1];
33         list[i+1]=hold;
34         exchanged=TRUE;
35       }
36     }
37   }
38   while (exchanged==TRUE);
39 }
40
```

Automatic Syntax Checker

Philip I. Nelson, Assistant Editor

How many times have you typed PRNIT instead of PRINT, or LIT instead of LIST? When it comes to typing, none of us is perfect. This automatic utility for the Commodore 64 can save you a lot of time by catching such mistakes before they're added to your programs.

Unlike some other computers, the Commodore 64 doesn't check BASIC lines for errors as you type them in. We all know a line like 010 MONKEY(BIZ)*5-DOGA$# is nonsense, but in many ways the computer treats it as normal BASIC. You can type in that line, list it, renumber it, even save it as a program and load it back into memory without any protest from your 64.

When a line starts with a number, the computer simply stores it in BASIC memory—no questions asked. The 64, like all other Commodore computers, can't find mistakes until it's *running* a program. As a result, after spending hours writing a program, you may spend hours more watching it crash until you've corrected all the typing errors.

"Automatic Syntax Checker" eliminates that headache by adding automatic error checking to your Commodore 64's BASIC. Once the Syntax Checker is installed, the computer automatically checks every BASIC line you type in. If the line is free of typing errors, it's added to your program as usual. If not, the Syntax Checker prints an error message and lets you try again. Since the line isn't correct, the Syntax Checker doesn't add it to your program.

Getting Started

Automatic Syntax Checker is written entirely in machine language, so you'll need to use MLX, the machine language entry program published frequently in the GAZETTE. Though it's written in machine language, you can use this program without understanding machine language at all. If you're using tape, change POKE782,1 to POKE782,0 in line 763 of MLX before running MLX. Here's the information you need to type in Automatic Syntax Checker with MLX:

Starting address: 49152
Ending address: 50109

Once you've saved the program, load and run it as you would any BASIC program. *Do not try to start this program with SYS.* Because it handles like BASIC, it's easy to make new copies of the Syntax Checker as well. Simply save it on a new disk or tape as you would a BASIC program.

When you run the Syntax Checker, it moves itself from BASIC program space to a safe memory location at 49152. After a brief preparation, it performs a NEW to let you type in your own programs. When you see the message CHECKER ON, you know the Checker is ready to go. Since this utility does NEW after installing itself, you should always run it *before* you load or type in any other program.

Although you can run BASIC programs while the Syntax Checker is active, some programs may POKE into the same memory space at 49152 or disrupt it in other ways. Thus, it's wise to turn the Syntax Checker off before you run any BASIC program. Type SYS 49152 and press RETURN: The message CHECKER OFF tells you the system is back to normal. To turn the Checker back on, enter SYS 49152 again (it won't do a NEW this time). Once the Syntax Checker is installed, SYS 49152 turns it on or off safely, whenever you want, without disturbing the BASIC program in memory.

Automatic Error Checking

When the Syntax Checker is active, it analyzes every line you type into the computer. If you type a command in direct mode (without a line number), the Syntax Checker simply passes it along to the computer (Commodore BASIC can find direct mode errors by itself). Thus, you can use direct commands as usual to load and save programs, and so on.

However, when you put a number at the beginning of the line, the Syntax Checker scans everything in the line to make sure it's correct BASIC. If no error message appears, then you know the line is correct—that is, it's all BASIC that the computer can understand. To

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demonstrate, run the Syntax Checker, then type in the following line:

```
10 PRINT "HI"
```

Since this line has no errors, the 64 behaves normally. After you press RETURN, the blinking cursor goes to the next line on the screen. You can list this program to confirm that it's there, or run it to see if it works. Now let's force an error. Move the cursor up and type over line 10 so it looks like this:

```
10 PNIRT "HI"
```

Because PNIRT isn't a BASIC word, the Syntax Checker prints SYNTAX ERROR. List the program again to see whether the computer replaced the good line with a bad one. As you'll see, the first (correct) version of line 10 is still there. The Syntax Checker won't let you add *or change* any lines in a program unless they're free of typing errors. This feature makes it handy for editing existing programs as well as writing new ones.

For instance, say that you get a program from a friend or enter one from the GAZETTE and decide to add an improvement. Even if you originally typed the program in with the "Automatic Proofreader," the Proofreader can't help when you add new lines. By catching errors *before* it adds anything to a program, the Syntax Checker prevents you from unintentionally "disenhancing" a program that already works.

Phantom BASIC

The Syntax Checker does far more than check BASIC keywords like PRINT for correct spelling. It passes judgment on everything else in the BASIC line as well. Using a modified version of BASIC, it performs a *phantom execution* of each new line, performing most of the same error checks BASIC would use if you ran the line in a program.

To do this, the Syntax Checker switches out the computer's BASIC and switches in a special, modified BASIC which it prepared when you started it up. The phantom BASIC "runs" the line to perform normal error checks, but stops short of actually completing the commands. This method can flush out a multitude of errors, including missing colons in multistatement lines, misplaced commas and parentheses, type mismatches (putting a string where a number belongs, and vice versa), missing parameters, illegal operations (like A$=B$−C$) and many illegal quantity errors as well.

Runtime Errors

But there are certain things the Syntax Checker cannot do. A program can contain innumerable flaws even when each of its lines is *syntactically* correct. To illustrate, type NEW and press RETURN, then type in the following line and enter RUN.

```
1000 NEXT
```

The NEXT statement in line 1000 is perfectly good BASIC—the 64 understands exactly what it means—but NEXT only makes sense when it's preceded with a matching FOR statement. This is a *runtime* error, so called because it can't possibly be detected without running the program. When you type in this line by itself, the Syntax Checker can tell that NEXT is a word from the BASIC language, but there's no way it can tell whether it's logical to put NEXT at that particular point in the program. There are many runtime errors (DEVICE NOT PRESENT, OUT OF DATA, etc.) which can't be found until a program is finished and running.

Thus, while the Syntax Checker looks after the fundamentals, catching obvious mistakes, it's up to you, the programmer, to make sure your creation makes sense as a whole. It can't read your mind to figure out what you really meant the program to do. Though it eases the burden of programming, the Syntax Checker can't perform magic: There's no way it can turn a badly structured, illogical program into something that works, and certain errors are simply beyond its scope.

Quirks And Compatibility

You should also keep in mind that ordinary BASIC lets you do some very odd things without signalling an error. LIST 10–30ABCDEF looks very strange, but doesn't cause an error. DIM A(5.001,26.3) is silly (you can't dimension a fractional number of array elements), but there's no "illegal fraction" error message to tell you about it.

In short, BASIC has some built-in limitations when it comes to error checking. Fortunately, most of its quirks are rarely encountered, and the ones shown above don't cause any real harm. But because the Syntax Checker uses existing BASIC routines, it's subject to the same quirks and anomalies. It doesn't sense errors that BASIC itself can't detect.

You may already have wondered whether the Syntax Checker can be used along with other programs like the Automatic Proofreader or "MetaBASIC." Though the Syntax Checker and the Proofreader work together just fine, they're designed for different purposes, so you'd rarely have reason to use them together. The Proofreader verifies the checksums in published programs that have already been tested for errors. The Syntax Checker is for use when you're writing your own original programs (for which no checksums exist).

The Syntax Checker also works with MetaBASIC. However, MetaBASIC's QUIT command turns off the Syntax Checker, too. So unless you want to turn off both programs at once, you must restart the Checker with SYS 49152 whenever you QUIT MetaBASIC. As you may know already, the more utilities concurrently active, the more fragile the system is likely to become. No matter what other programs you're using at the time, it's always best to disable the Syntax Checker with SYS 49152 before you run a BASIC program.

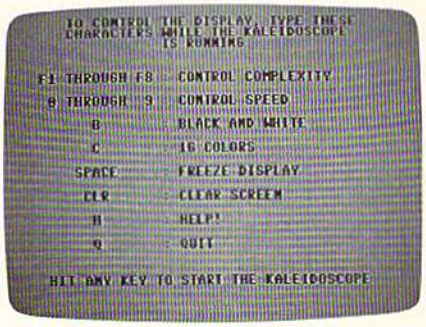
Space doesn't permit a detailed explanation of how this program works, but here's a brief synopsis. When the Syntax Checker sets up, it copies BASIC and the computer's operating system (OS) from their normal places in ROM (Read-Only Memory) into underlying free memory, then modifies them extensively. When you enter a numbered line, the program turns off the computer's ROM and uses the modified BASIC and OS. After it scans the input line, the Syntax Checker either adds it to the program or signals an error. In both cases, ROM is turned back on before the blinking cursor reappears.

See program listing on page 124.

KALEIDOSCOPE

Sam Bowne

Remember your fascination as a child looking through a kaleidoscope? This electronic version entertains the same way—but you have control. Originally written for the 64, we've added versions for the unexpanded VIC, Plus/4, and Commodore 16.


TO CONTROL THE DISPLAY, TYPE THESE
CHARACTERS WHILE THE KALEIDOSCOPE
IS RUNNING
F1 THROUGH F8 - CONTROL COMPLEXITY
0 THROUGH 9 - CONTROL SPEED
B - BLACK AND WHITE
C - 16 COLORS
SPACE - FREEZE DISPLAY
CLR - CLEAR SCREEN
H - HELP!
Q - QUIT
HIT ANY KEY TO START THE KALEIDOSCOPE

Press H to see the Help screen (64 version).

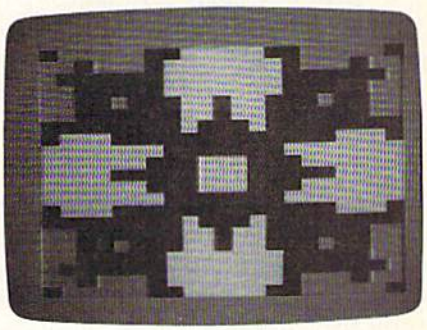
Here's a program that lets your Commodore computer show off. "Kaleidoscope" displays a multicolored, constantly changing but symmetrical pattern which might remind some of a Persian rug, but is most like a kaleidoscope.

But unlike the kaleidoscopes that children (and some adults) enjoy, this one lets you control the speed, complexity, and a number of other things.

Simple Operation

After typing in the correct version for your computer, save it to disk or tape and run it. After a few seconds, you'll see either the title screen or an error message. If the program says ERROR IN DATA STATEMENTS, check the DATA statements in the last section of the program. (To help ensure a correct typing entry the first time, I recommend using the "Automatic Proofreader," published frequently in the GAZETTE.)

The first time running, don't worry about the screen instructions. Just press RETURN twice after you see the title page, and you'll see the kaleidoscope in action. Next, type H (for Help) to get to the menu. (H may be pressed any time during the running of the program.) Here's the menu with comments on how to use it:



A less complex pattern (VIC) gives you larger colored areas . . .

f1–f8: The eight function keys control the complexity of the pattern; f1 is the most complex and f8 the simplest. (On the Plus/4, note that f8 is equivalent to the HELP function key.)

0–9: The ten digits 0–9 control the speed with which the pattern changes. Zero is the fastest, and 9 causes a delay of about five seconds between pattern changes.

B: Displays black and white only. This is for purists or people with black and white TV sets.

C: Returns to color mode.

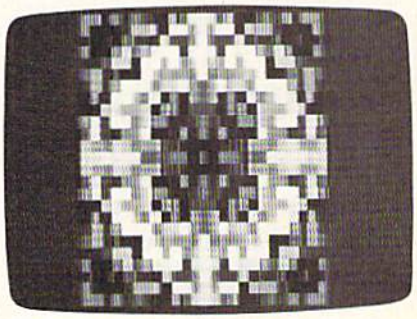
SPACE: Freezes the display until another key is pressed.

SHIFT-CLR: Clears the screen momentarily. (At high speed, the pause is almost unnoticeable).

H: Help. Returns to the menu.

Q: Quit. Ends the program.

See program listing on page 126.



. . . while increased complexity creates a splash of colors—up to 121 on the Plus/4 and 16.

BASIC magic

Taking Center Stage With Screen Titles

Michael S. Tomczyk

Michael S. Tomczyk is a former Commodore marketing executive and product designer. His recent book, The Home Computer Wars, *describes the rise of Commodore and is published by COMPUTE! Books.*

This month, we'll explore some simple techniques for creating and centering screen titles, which you can mix and match to customize your opening program "headlines."

These programs are designed to work on the Commodore 64, VIC-20, Plus/4, 16, and 128 (64 mode). All programs are written for 40-column displays. To adjust any program for use on the VIC, substitute the number 22 in place of the number 40 wherever it appears in our examples and in the text.

Displaying A One-Line Title

To display a title at the top of your screen, begin by clearing the screen, which puts the cursor at the upper left corner, then print your title. The title can include words, numbers, graphics, and different colors. Your title doesn't have to extend all the way across the top of the screen; but if you print it in reverse characters, it'll look much nicer with enough spaces to make the line extend all the way across. Here are a few quick examples:

```
10 PRINT CHR$(147)"BLAND OPENING
   TITLE"
```

Type RUN and press the RETURN key. (Pretty boring title—more like no title at all.) All we did was clear the screen and print some words. When you PRINT CHR$(147) it's the same as clearing the screen. Now try this:

```
10 PRINT CHR$(147) CHR$(18)
   "REVERSE OPENING TITLE"
```

Run this program. As you can see, most titles look nicer when they're printed in reverse characters. In this example, we begin by clearing the screen, then using CHR$(18), which is the same as CONTROL-RVS ON. Now anything that follows in this PRINT line will be displayed in reverse. But this simple title is still a little sloppy. To create a more professional-looking title, we need to extend the reverse bar all the way to the right edge of the screen. Try this:

```
10 PRINT CHR$(147) CHR$(18)
   "REVERSE OPENING TITLE{19
   SPACES}"
```

All we did here was add 19 blank spaces at the end of the line. To add the spaces, press the space bar 19 times after the title and before the final quotation marks. (VIC users should type only one space after the title.)

If your title is longer or shorter than our example, just count the characters and spaces in your title, subtract from 40 (22 for the VIC) and that's how many spaces you need at the end. For instance, in a title like "FACTS ABOUT HALLEY'S COMET" there are 26 characters including spaces. Subtract 26 from 40, take the result (14), and put 14 spaces after the title to make the reverse bar extend across the screen. An even easier way to print a full line is to notice the location of the first quote mark and space over, until the last space in the line is directly underneath the quotation mark. If you use this technique, make allowances for non-printing characters like CTRL-RVS ON or color changes.

Centering

Most good screen titles are centered—so let's try that with the HALLEY'S COMET example (VIC users type 4 spaces instead of 13):

```
10 PRINT CHR$(147)"{13 SPACES}
   HALLEY'S COMET"
```

or move it down one line:

```
10 PRINT CHR$(147):PRINT"{13
   SPACES}HALLEY'S COMET"
```

or print it in reverse and centered at the top of the screen:

```
10 PRINT CHR$(147) CHR$(18)"{13
   SPACES}HALLEY'S COMET{13
   SPACES}"
```

or print it in reverse and centered one line down on the screen:

```
10 PRINT CHR$(147):PRINT CHR$(18)
   "{13 SPACES}HALLEY'S COMET{13
   SPACES}"
```

REM: *In our "top of the screen" examples, the difference between putting the title on the top line and putting it on the second line involves the use of separate PRINT commands.*

Every PRINT statement automatically moves down to the next line in BASIC, unless you "glue" them together with a semicolon (;).

If you type:

```
PRINT"X":PRINT "Y":PRINT"Z"
```

and press RETURN, these three letters will appear on different lines. But if you type:

```
PRINT"X";:PRINT"Y";:PRINT"Z"
```

they will appear on the same line because the semicolons "glue" them together.

In our first screen title examples, the title appears on the first line because we put the clear screen command and the title in one PRINT statement.

In some of the examples, we inserted a blank line by using two separate PRINT statements instead of one to print the clear command and then print the title. The computer sees two separate PRINT commands and puts each one on a different line—first it clears the screen, then moves one line down to print the title.

Getting A Little Fancier

We can vary our titles by making them "deeper"—using two or three lines instead of one:

```
10 PRINT CHR$(147);:FOR SP = 1
```

```
   TO 40:PRINT CHR$(18)" ";:N
   EXT
12 PRINT CHR$(18) "{13 SPACES}
   HALLEY'S COMET{13 SPACES}";
14 FOR SP = 1 TO 40:PRINT CHR$
   (18) " ";:NEXT
```

Line 10 clears the screen and uses a semicolon to stay on the top line (otherwise the computer would skip one line down). Then we use a FOR-NEXT loop to repeat an action. In this case, we print one reverse space, and the FOR-NEXT loop causes it to be repeated 40 times. A reverse space appears on your screen as a solid block. Finally, the NEXT command ends the loop (see the REM note below).

Line 12 prints the "ReVerSe ON" command (remember, printing a CHR$(18) is the same as printing a RVS ON). Then we have 13 spaces (press the space bar 13 times), the title, and 13 more spaces. The semicolon at the end of this line is like glue. (Try running the program without the semicolon and see what happens).

Line 14 is similar to line 10 except we don't have to clear the screen.

REM: *To repeat an action, we use FOR-NEXT loops. The FOR part of the loop specifies how many times the action will occur. For example, "FOR SP=1 TO 40" tells the computer to "count" from 1 to 40 which is how we get 40 repetitions. Whatever comes between the FOR and NEXT in the program is the action, or actions, which will repeat. While the loop is active, the variable SP is counting from 1 to 40 one number at a time.*

In BASIC programming you can start the FOR part of the command on one line, include several lines of commands you want to repeat, and end the loop with the NEXT command. This is why in some programs you may see a FOR, then a number of program lines, then a NEXT all by itself. These are very long FOR-NEXT loops.

Automatic Centering

So far, we've centered our titles manually. Now we can make the computer center the titles automatically—here's how:

```
5 PRINT CHR$(147)
10 H$ = "HALLEY'S COMET":GOSUB
   1000
20 FOR L = 1 TO 40:PRINT CHR$(
   96);:NEXT
30 PRINT:PRINT:PRINT "HALLEY'S
   COMET IS COMING IN 1986!"
999 END
1000 FOR C = 1 TO (40-LEN(H$))
     /2:PRINT " ";:NEXT:PRINT
     {SPACE}H$:RETURN
```

Line 5 clears the screen. Line 10 defines your title as the string variable "H$." From now on, H$ is the same as the title. The GOSUB command means "GO TO SUBROUTINE" so GOSUB 1000 means GO TO THE SUBROUTINE AT LINE 1000. The computer now jumps to line 1000 and executes that line.

Line 1000 looks more complicated than it is. The first part begins a FOR-NEXT loop. Look inside the parentheses first. LEN(H$) means the LENgth of the title represented by the variable H$. In this program, H$ represents "HALLEY'S COMET," and since there are 14 characters including spaces in "HALLEY'S COMET," LEN(H$) equals 14. Using LEN(H$) is the same as using the number 14.

Now look a little farther. 40−LEN(H$) is the same as 40−14, which is the same as 26. Thus, the calculation inside the parentheses represents the number 26. Next, we go outside the parentheses to divide that number by 2. The result is 26/2 or 13.

So the first part of line 1000 means FOR C equals 1 to 13, print a space. The semicolon glues the spaces together on the same line. NEXT closes the loop after the 13 spaces have been printed.

Now that we are properly centered on the screen, we print H$, which is the same as printing our title. The RETURN command sends the computer back to the end of line 10. It now continues on to line 20.

Line 20 uses a FOR-NEXT loop to print a horizontal line across the screen using the graphics character represented by CHR$(96).

Line 30 uses PRINT commands all alone to insert two blank lines, then prints a message. This is where our program—a quiz, test, or list of facts about Halley's Comet—would continue.

Line 999 contains an END command—you should always include an END command just before the GOSUB routine.

To print and center the title in reverse characters, add the following lines to the program.

```
1000 FOR C = 1 TO (40-LEN(H$))
     /2:PRINT CHR$(18)" ";:NEX
     T:PRINT H$;
1010 FOR C = 1 TO 40-(LEN(H$)+
     INT((40-LEN(H$))/2)):PRIN
     T CHR$(18)" ";
1020 NEXT:RETURN
```

This new subroutine displays the title in reverse and centers it on the screen. Our new line 1000 includes CHR$(18) to print the spaces and title in reverse.

Line 1010 adds together the total number of spaces on the left side of the title and the number of characters in the title (H$), then subtracts that number from 40 to give the number of reverse spaces that have to be printed on the right side of the title. This is necessary because if you have a title with an uneven number of characters, you won't get the same number of spaces on each side of the title—one side will be one off. So we take the left side spaces and the number of title characters, add them together, and subtract them from 40. The remainder is how many reverse spaces we need on the right side of the title to fill up the rest of the line.

Next month, we'll continue with this topic and look at some slightly more sophisticated techniques.

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computing for families

In Search Of The Computer Sandbox Part 2

Fred D'Ignazio
Associate Editor

In this month's column, we'll see how you can turn your computer into a sandbox using software you may already own. And I've prepared a checklist you can use to evaluate software and computer activities to see if they are up to "sandbox" standards.

You don't need to purchase commercial "problem-solving" programs in order to turn your computer into a problem-solving environment. Much of the software you already own can be used to help children develop skills in problem solving, communication, and critical thinking. The key is to turn your staid and stuffy machine into a computer *sandbox*. The important thing is not the software but *how you use it*.

Recipe For Sandbox Activities

Here's a quick checklist of characteristics that all good sandbox activities should have:

First, create activities that are playful, that encourage children to experiment with different ideas and styles of thought. In some cases, there may be only one right answer, but the activities should let the child approach that answer on many different paths.

Second, look for activities (and software) that teach the child real-world skills, even in the context of a make-believe world. Facts are something that a child may or may not remember, but skills are things a child can practice and use the rest of her life.

Third, look for software (and create activities) that encourages your child to be thoughtful. The activities should not push a child to press a button or look for a quick fix. Instead they should challenge her to turn something over in her mind before she makes a choice and presses a key.

Most of all, sandbox activities should mimic a real sandbox and attract the child, like a magnet. Like a real sandbox they should offer your child:

- Freedom. A "sandbox" is a world where adults are welcome but where children make the *big* decisions.
- Fantasy. A child should be encouraged to soar to the outer reaches of her imagination.
- Props. There should be a rich array of props for the child to wheel onto her make-believe "sandbox" stage and incorporate into her world's drama.
- Plot. Storymaking and storytelling give meaning to this make-believe world. Decisions and events can have life-or-death significance.
- Heroics. A child enters a new world when she climbs into a sandbox—and she becomes an argonaut, adventurer, voyager, explorer, discoverer. Her stage is tiny, but she is at its center and in control.
- Sand in the hands. One of sand's great joys is its infinite malleability. It can be shaped into anything a child can imagine. Computer software should have this same attribute.
- Sandy revisions. Sand can be "edited" effortlessly. A child can edit a structure by lopping off a tower or by adding a new moat, tunnel, or bridge. Or if she wants to start over, she can erase it instantly.
- The perfect medium. Sand is a medium that's just right for small hands. It doesn't fetter a child or dampen her limited motor skills. Instead it enhances and amplifies her abilities. Most important of all, it stimulates confidence and self-esteem, two primary ingredients for intelligence and later academic success.

Puzzles And Clouds

When we use a computer, we need to let it do what it does best, and it should help us do what *we* do best. One of the things we do much better than computers is create and recognize patterns. Our ability to solve problems is a direct result of our skill in recognizing patterns and creating new patterns out of a rich association of memories, ideas, and experiences.

Playing in a sandbox is a good example of pattern creation and recognition. Out of the amorphous sand come villains, heroes, trucks, dragons, and crocodiles. It's a bit like watching the play of clouds in the sky—only much more dynamic because we can interact with the patterns that we create and reshape.

According to Hans Moravec, a roboticist and artificial intelligence scientist at Carnegie-Mellon, patterns are like pieces in a puzzle. And there are puzzles inside of other puzzles (patterns inside patterns). We go through life like scavengers searching for new pieces of these larger puzzles. Gradually more of the missing pieces are filled in, and the really big puzzles, or patterns, begin to make sense.

The computer can help us in this lifelong quest if it helps us discover new pieces for our puzzles, if it encourages us to become active seekers, and if it equips us with skills to make our search more efficient, fruitful, and joyous.

If you have any thoughts about sandbox activities, write Fred D'Ignazio, c/o COMPUTE!'s GAZETTE, P. O. Box 5406, Greensboro, NC 27403.

simple answers to common questions

Tom R. Halfhill, Staff Editor

Each month, COMPUTE!'s GAZETTE *tackles some questions commonly asked by Commodore users and by people shopping for their first home computer. If you have a question you'd like to see answered here, send it to this column, c/o* COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403.*

Q. I see that Commodore's new Amiga and the Atari ST are being described as 16-bit computers. Can you explain the difference between an 8-bit and 16-bit computer and why 16-bit is better?

A. Describing a computer as an 8-bit or 16-bit machine refers to the microprocessor chip which is its *central processing unit*, or CPU. The CPU is a silicon chip—about the size of a fingernail—which is the computer's main brain. It's responsible for fetching program instructions from memory, carrying out the instructions, and storing the results of calculations back into memory. Basically, it controls or supervises everything that happens in the computer, much as your brain controls your body.

At the chip level, all information is coded in electrical signals which represent binary numbers. The binary numbering system consists of only two digits: 0 and 1. Since electrical signals can be either on or off, they're ideal for representing binary digits. An off-signal equals 0; an on-signal equals 1. The term *bit* is an abbreviation of *binary digit*. Thus, a bit is either a 0 or 1. By stringing bits together in various patterns, numbers larger than 1 can be represented.

Some CPU chips are designed to handle larger strings of bits than others. Many pocket calculators are driven by four-bit chips; they can accept and manipulate information which is fed to them in strings of only four bits at a time. Most home computers have CPU chips which can handle eight bits. Higher-end personal computers usually can process data in strings of 16 bits. Some CPUs are hybrids and are referred to as 8/16-bit or 16/32-bit chips. As computer technology advances, engineers are able to design chips which can process larger and larger chunks of information. (The accompanying table lists the common CPU chips found in home and personal computers.)

CPU Chip	Type	Computers
6502	8-bit	VIC-20, PET, Apple II/II+, Atari 400/800/XL
6502B	8-bit	Apple IIe (6502-compatible)*
6502C	8-bit	Atari 130XE (6502-compatible)
65C02	8-bit	Apple IIc (low-power 6502-compatible)
6510	8-bit	Commodore 64 (6502-compatible)
7501	8-bit	Commodore Plus/4, 16 (6502-compatible)
8502	8-bit	Commodore 128† (6502-compatible)
6809	8-bit	TRS-80 Color Computer
Z80	8-bit	Commodore 128†, Coleco Adam, Sinclair ZX80/ZX81, Timex TS1000, TRS-80 I/II/III, MSX, Mattel Aquarius, Osborne CP/M, Kaypro CP/M, other CP/M computers
80C85	8-bit	TRS-80 Model 100 (low-power 8085-compatible)
8088	8/16-bit	IBM PC, PCjr, XT, Tandy 1000
8086	16-bit	Compaq, most IBM PC compatibles
80286	16-bit	IBM AT
TMS9900	16-bit	TI-99/4A
68000	16/32-bit	Amiga, Atari ST series, Macintosh

*For increased compatibility, Apple recently replaced the 6502B in the Apple IIe with the same low-power 65C02 chip found in the Apple IIc.

†The Commodore 128 contains two independent CPUs, an 8502 and Z80. The 8502 is for the 64/128 modes, and the Z80 is for CP/M mode.

What makes a 16-bit computer better than an 8-bit computer? As a general rule, a CPU which handles larger strings of bits can process data faster. Naturally, that means the computer runs your programs faster. There are exceptions, however. For instance, the Texas Instruments TI-99/4A home computer (discontinued in 1983) has a 16-bit CPU, but other design factors make it run slower than most 8-bit home computers such as the Commodore 64 and VIC-20.

Also, a CPU that can process larger strings of bits usually can access more memory as well. Most 8-bit computers can directly address only 64K of memory without special tricks such as bank-switching. Most 16-bit computers can address at least a megabyte (1,024K) and sometimes as much as 16 megabytes.

There are many other considerations when judging a computer, of course, including cost, software availability, and suitability to the task at hand. So a 16-bit computer isn't necessarily "better" than an 8-bit computer. But it is potentially more powerful.

When reading about CPUs you may also see a phrase like "the microprocessor is clocked at 1 MHz." This refers to the speed of the chip.

A higher CPU clock speed usually means a faster computer, but too many other design factors also affect performance to make this a hard and fast rule. It's not unusual for a program on a 1 MHz computer to outrun the same program on a 2 MHz computer. Raw specifications are useful guides for comparisons, but balancing the value of one computer against another involves many more variables.

The Operating System

Charles Brannon
Program Editor

Computer terminology is filled with flavorful terms—*byte, floppy, nybble*—as well as mundane—*filespec, CPU,* and *raster-scan.* These terms are used to tersely communicate complicated concepts, but are too often spoken without a solid understanding of their meaning. Novices and even experienced users may find themselves with a mental mishmash of how computers work. A prime example is the concept of an *operating system.*

The most important distinction to make is that the operating system, although often stored in permanent read-only memory (ROM), is *not* part of the hardware of your computer. ROM is simply an unerasable form of RAM. The memory chips that store your programs are part of the hardware, but the information in them is ethereal, comprised of the state of thousands of tiny switches. A switch is hardware, the position of a switch is not.

It's also incorrect to describe a function of a video chip as being performed by "the operating system." The operating system can only control video indirectly via the video hardware. A video chip is a hard-wired maze of intricately interconnected switches. It's not appropriate to think of a video chip as a program. Software *describes* a process; hardware *performs* the process.

The operating system (OS) of a computer is made of programs and routines, the same kind of programming that makes up a game, a word processor, or the BASIC language. The operating system is the underlying programming of a computer, the routines that create the personality of your computer. It provides a host of useful sub-programs that can be used by other programs. The operating system makes a computer system a coherent environment rather than just a bunch of chips.

Nuts And Bolts

If you designed your own computer, you would start with a microprocessor, then add RAM and ROM. This minimal computer is bereft of communication. You'd have to add some matrix-scanning chips and circuitry to support a keyboard (or go all the way and put a microprocessor in the keyboard as well). Next, you would add video circuitry to support screen output, from a simple character display to full color high-resolution bitmapped graphics.

The computer is still not very useful without some input/output chips to support printer output, tape or disk input/output, and the use of modems. Finally, you'd add the optional extensions such as joystick, paddle, and lightpen ports, an expansion port for extra memory and/or ROM cartridges, and specialized chips for floating point math and sound synthesis.

You have a computer now—but it's still useless without an operating system. The smallest ROM operating system is a *bootstrap* routine to load a complete operating system from disk into RAM. This technique is used on some CP/M computers, as well as the new Atari 520ST and Commodore Amiga.

Few programmers want to reinvent the wheel every time they program. Even printing text to the screen is tedious without an operating system; you have to POKE the byte representing each character into the proper cell of screen memory. Getting input from the keyboard involves scanning the keyboard yourself, converting the keycode to ASCII, echoing the character to the screen, permitting corrections, and storing the characters in a buffer (block of memory).

It's much easier if common routines like character printing and keyboard input are built into the computer. In fact, there are hundreds of subprograms that are general enough to be used by a majority of programs. For text printing, a good operating system supports functions such as setting the cursor position, printing a character, printing a string of text, supporting carriage return/linefeed or clear-screen, as well as supplying graphics functions to change colors, draw a pixel, line, circle, rectangle, and perform area fills.

Similar detail is supported for screen-oriented input, peripheral programming, direct memory access (DMA) for high-speed disk data buffering, memory management, interrupt and event processing (such as cursor flash and keyboard type-ahead), object management (support for the windows, menus, and dialog boxes found on the Macintosh, 520ST, and Amiga), even multitasking (simultaneous execution of multiple programs).

An extension of the operating system, the disk operating system (DOS, pronounced "doss"), is also stored in RAM, excepting the rare case of Commodore's disk drives. A DOS may carry the entire operating system with it, but it's especially concerned with disk-specific routines to read or write a disk block, allocate/de-allocate disk blocks, support named files, rename and delete files, create nested directories and multiple volumes (simulating multiple disk drives within a single unit as in a hard disk), and much more.

The operating system is rarely explained because it's taken for granted. Although you may never actually see or use the operating system, it comes alive when you turn the power on, hums quietly to itself in the background, and orchestrates every function of the machine. An almost invisible entity, the operating system is the most important part of your computer. ■

If you've discovered a clever time-saving technique or a brief but effective programming shortcut, send it to "Hints & Tips," c/o COMPUTE!'s GAZETTE. *If we use it, we'll pay you $35.*

Escape From Quote Mode

Joseph R. Charnetski

Quote mode is both a handy and a frustrating feature of Commodore computers. If you've programmed at all, you know how convenient it is to control actions such as clearing the screen or cursor movements from quotes within a PRINT statement. But you also know how sticky matters can get when you edit while locked into quote mode. There are occasions when it needs to be turned off. Here are a few solutions:

- Pressing RETURN always turns off quote mode, insert mode, and reverse characters. Insert mode is similar to quote mode, except that DELete shows up as a reverse-T (turn insert mode on by pressing SHIFT–INST/DEL).
- A sometimes unwelcome side effect of pressing RETURN is that the current program line is either added to the program or executed immediately. SHIFT–RETURN functions like a regular RETURN, but the program line is not put into memory. You can then cursor up and make corrections.
- Both kinds of RETURNs bring you to the beginning of the next line. To cancel quote mode while staying in place, just type SHIFT-2 (to get out of quote mode) and then DELete, to erase the quotation mark.

These three ideas work fine when you're writing or editing a program, but what about when a program is running? You might be GETting information from the user of the program or reading a sequential file. Anytime the computer prints quotation marks, quote mode is toggled on or off. To make sure it's off, you can **POKE 212,0** (on a VIC or 64) or **POKE 203,0** (on a Plus/4 or 16).

Default INPUTs

Norman E. Hovis, Jr.

The INPUT statement is an excellent way to get information from a person using your program. But what happens if the user just presses RETURN without entering anything? What does INPUT default to?

If a numeric variable in an INPUT statement has not previously appeared in the program, the default value is zero. A string variable not yet used defaults to a null string—an empty string with a length of zero.

But if the INPUT variable already has a value and the user presses RETURN, the variable keeps its old value. For example, say your program asks for a last name with INPUT"LAST NAME"; A$ and then later on INPUT"ZIP CODE";A$. The user enters "Swanson" for the last name, but doesn't know the zip code and presses return. Since A$ was defined as "Swanson" earlier in the program, the zip code becomes "Swanson."

There's a way to solve the problem: by building default values into INPUT statements. (VIC owners should delete the first semicolon. There's a bug in the way VICs handle prompts longer than 22 characters before an INPUT.)

```
100 PRINT"LEVEL 1-9 (1 = EASIE
    ST)";:INPUT"{3 RIGHT}5
    {3 LEFT}";X
```

This line might be used, for example, at the beginning of a game with nine levels. The key to this technique is the cursor movement. A prompt is printed, followed by three cursor rights, the number 5, and three cursor lefts. Moving three spaces right puts the cursor just past INPUT's question mark. The lefts then move the cursor back to the usual space. When the program gets to this line, the cursor is blinking on top of the number 5, and the user only has to press RETURN to get this default value. If you want more characters, add the appropriate number of cursor lefts after the last character.

This idea can also be used to change the way the cursor blinks. In the example above, change the 5 to a graphics character. The left graphics characters on B, I, and + seem to work well (hold down the Commodore key to get the graphics on the left side of the keys).

Stop And Go Printing

Thomas R. Jansen

Let's create a programming problem. In the middle of a debugging session, you find you need to examine the values in an array containing 100 elements. So you press STOP and enter **FOR J=0 TO 100: PRINT J,A(J): NEXT**. The numbers fly across the screen, scrolling off the top before you can look at them.

Within a program, you can create a pause with a GET statement. But if you try to GET a character in direct mode, you'll see ILLEGAL DIRECT ERROR. GET and INPUT work only within a program. And you can't add a program line without erasing the current values of all variables, variables you need to look at.

You could cursor to the bottom of the screen, type the line again, and quickly press CTRL to slow things down. But the CTRL key only slows a VIC or 64 down a little (use the Commodore key to slow down a Plus/4 or 16).

Another idea is to insert a delay loop that counts to 1000. Again, it only slows things a bit. Is it possible to start and stop the printing?

The answer is WAIT, a command which may be unfamiliar to many Commodore programmers. Enter this line, in direct mode (on the Plus/4 and 16, use 239 instead of 198):

```
FOR J=0 TO 100: PRINT J,A(J): POKE 198,0: WAIT 198,15: NEXT
```

Memory location 198 (239 on the Plus/4 and 16) keeps track of how many characters are in the keyboard buffer. First, POKE a 0 to this location to tell the computer that no (0) keys have been pressed. The computer then executes the WAIT command, which stops everything until a certain memory location—198 in this case—contains a certain pattern.

The screen displays the first number. It then stops until you press a key. Since the space bar repeats, hold it down to scroll rapidly through the numbers, and release it to stop things again.

The opposite effect can also be achieved with WAIT (change the 198 to 239 on the Plus/4 and 16):

```
FOR J=0 TO 100: PRINT J,A(J): WAIT 198,1,1: POKE 198,0: NEXT
```

The numbers print and scroll normally until you press a key, which stops everything until you press a key again. It may sound strange, but the second number 1 makes the computer wait until an even number of keys has been pressed. Since zero is an even number, the computer stops waiting—it continues on—as long as no keys have been pressed. When you press one key (an odd number), it starts waiting until you press a second key.

These techniques are very helpful for creating pauses when you're looking through an array or PEEKing a large block of memory. You can also put them inside a program when you need a pause feature.

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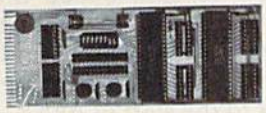

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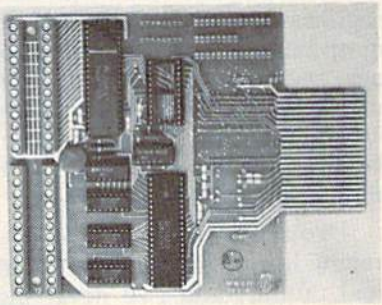

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The Creature In Its Cage

Richard Mansfield
Senior Editor

The author wrestled with this program. Most of us wrestle with most programs. If you find yourself going up blind alleys, surrounded by bugs, rewriting your ML a dozen times—you're in good company. No matter how much advance planning you do, you'll still have to subdue the creature in its cage.

Programming is rarely a straight line from concept to finished product and I've never met anyone who could predict in advance precisely how he or she was going to write a routine of any sophistication.

Please, as we describe how the example program below was constructed, also be reminded that this is only one of many ways to accomplish the task set forth. Starting from scratch, you might well arrange things differently, use different techniques. If your program works, that's what matters. Different methods can be every bit as effective as the ones outlined here.

Housekeeping Preliminaries

Last month we described the labels in Program 1, a short utility which is designed to transform an ML program into a "BASIC loader," (a series of DATA statements that can be POKEd into RAM to form the runnable ML program.) Now let's finish our examination of this program by exploring its structure, its logic.

As usual, there are a few housekeeping preliminaries before the action starts. First off, we set up some important pointers and registers. In line 270 we put the two-byte address of the start of BASIC (where programs are stored in RAM) into the pointer, PF, which will keep track of where we are as the BASIC program is built.

In line 280 we set up 50000 as the first line number for our BASIC program. How do $50 and $C3 combine to make 50000? It's a bit confusing at first. You can use either hexadecimal numbers (which are signified by a $ in front of them) or ordinary decimal numbers when writing ML programs. Some people find hex easier to use because it represents numbers somewhat the way the computer sees them. Break a four-digit hex number in half and you've got two byte-size numbers.

Large numbers are always stored in two consecutive bytes. The byte which is higher in memory is called the "high byte," and the byte lower in memory the "low byte." The computer will multiply the high byte by 256, and then add the low byte to form the final amount. So, if you put 80 into the lower byte and 195 into the higher byte, the resulting amount will be 50000. (195 * 256 = 49920, then add the 80 to get 50000.) $50 is hex for 80 and $C3 is hex for 195. Here's how the number 50000 would look if you could see computer memory: $50 $C3.

Special Tricks

Fortunately, there's a simpler way to set up two-byte numbers. Let the assembler do it. If you're just starting out with ML, the easiest way to handle the problem of setting up registers or pointers which are larger than 255 is to define a label and use the #< pseudo-op. Here's how. First add a label to hold 50000; put it up in the label definition area:

```
230 FIFTYTHOU = 50000
```

Now you've told the assembler that the word FIFTYTHOU stands for 50000. Then to break up the number into two bytes so the computer can understand it, change line 280 to read:

```
280 LDA #<FIFTYTHOU:STA
  LINENUM:LDA #>FIFTYTHOU:STA
  LINENUM+1
```

Special tricks and techniques that your assembler can do to help you program in ML are called *pseudo-ops*. They're not machine language operations the computer can execute, they're instructions to the assembler. When you use the #< pseudo-op, it will extract the lower byte from a label (< means lesser); the #> extracts the greater byte. So you don't need to figure out how to split 50000 into two bytes, you can let the assembler do it for you. Notice that we did just that when we wanted to set up a pointer to the start of BASIC in line 270.

Another convenience offered by labels is that you could easily change the starting line number by simply changing the label in line 230:

```
230 FIFTYTHOU = 900
```

and your first line number in the resulting program would then be 900 instead of 50000.

We also need to put a zero into the counter that will keep track of how many numbers appear in each DATA statement as the BASIC program builds. So we load a 0 into the accumulator and store it in COUNTER. Then we set the Y register to zero by transferring the 0 from the accumulator to Y (TAY) and store the zero into the lowest byte in BASIC RAM memory. All BASIC programs start with this zero.

Inside BASIC

Now we raise the pointer to BASIC RAM by INC PF and we're ready to start transforming our ML program into BASIC. We've come to the main loop.

Take a look at the figure below: It shows what a BASIC program looks like inside the computer. This is what we've got to build for the computer to recognize it and be able to run it. There are several component parts to each BASIC

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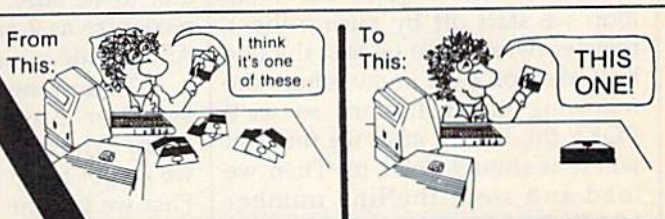

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line. First there is a two-byte "line link" which is a pointer to the RAM address where the next BASIC line starts. Then a two-byte line number. Note that in both the line link and the line number, the low byte comes first. Then the actual meat of the line (in our case it will be numbers separated by commas to make up a DATA statement). Finally the line concludes with a 0 and the next line starts over with line link, line number, etc.

When A Number Isn't A Number

Now we pick off the first byte of the ML program we're translating into BASIC (450) and store it in the place where the ROM routine will expect to find it. The first byte in the ML program might be 25. We've got to change it, now, into *the two characters* "2 5" so we can put it into BASIC. A BASIC DATA statement is filled with characters. They are, to be sure, the characters we recognize as 2 and 5, but that's the ASCII code.

To turn the number 25 into the characters 2 and 5 so we can POKE them into our DATA statement, we've got to go through two steps. First we put the number into the Y register after getting it into the Accumulator (TAY transfers it from A to Y in line 450). Then we put a 0 into the Accumulator. The ROM routine we've called INTAFP wants us to give it the high byte of our number in the Accumulator and the low byte in the Y register. We will never have a high byte because, although the ROM routine will work on two-byte-large numbers, all of our numbers are going to be one byte large: They're the individual bytes which make up the ML program.

Then we JSR to the routine in line 470. To find out what preconditions are expected by ROM routines, you use books like *Tool Kit: BASIC*, *Mapping the 64*, and *Mapping the VIC* (COMPUTE! Books). These authors have carefully studied the ROM routines and tell you what you need to do before calling on a BASIC ROM routine.

We're not home free yet. Our 25 has been changed from an integer (25) into a floating point number (five bytes which represent 25.0000000), but there's one more JSR which changes it from floating point into ASCII characters. We JSR INTASCII and, now, the characters "2 5" are sitting at address $100 where we pick them off and store them into the BASIC program we're building (line 480). That INTASCII routine is considerate enough to put a 0 at the end of the characters it stores at $100. That's how we know when we've reached the end of the string and can BEQ. After all, we're dealing with numbers ranging between one and three characters, 0–255.

Things are pretty straightforward from here on. We raise the counter and check to see if we've yet put ten numbers on our DATA line. If not, we store a comma (530), raise the pointer into the ML program, and go back up again through the LOAD–TRANSFORM–STORE loop for nine more bytes from our ML program. By now, we've built this much BASIC:

```
50000 DATA 25,
```

and we quickly loop through the entire line until COUNTER counts up to ten (550) when we are forced to branch down to NEWLINE (590).

Because we've been storing commas after each number, there will be a comma at the end of our line:

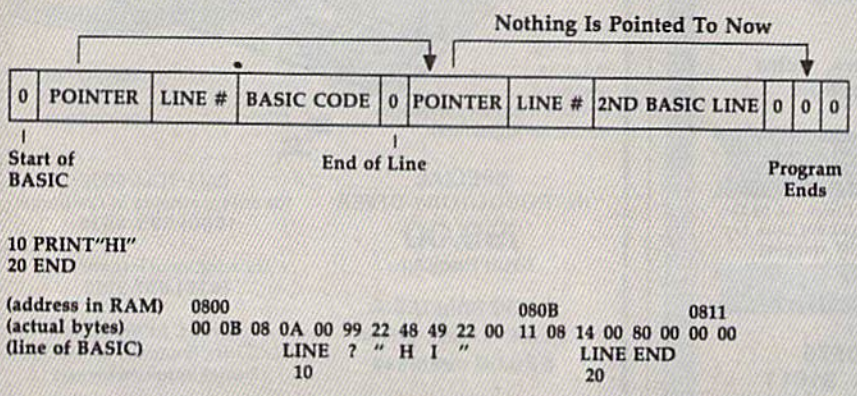
```
50000 DATA 25,172,13,12,0,0,155,169,10,38,
```

and we want to get rid of it. That's why we DEY at the start of NEWLINE (590). The Y register has been keeping track of our position on each line and will soon be used to calculate where in memory we should put the 0 end-of-line indicator. By lowering Y, we force the computer to store that 0 right on top of the last character in the line, on top of that unwanted comma. Then, after storing the 0 at the end of the old line, we reset the counter.

Just What We've Been Waiting For

We do a little juggling here. PF is still pointing to the location of the link bytes within the first line, so we save that address in a special

A BASIC Program's Structure



Each time through our main loop we start off by raising the Y register twice to get us past the line link. We don't yet know where the following line will start, so we'll POKE the link in after we find out where it should point to. Then we load and store the line number (360–370) and add 10 to it (380–390) so it will be ready the next time through the loop. Then we store $83, which is BASIC's symbol for the word DATA. So far we've built this in BASIC:

```
50000 DATA
```

Notice that as we move up through the BASIC RAM, building the program, we keep raising the Y register. Y is added to whatever address is held in PF when we use the Indirect Y addressing mode: STA (PF),Y.

Now we come to the hardest part of the program and we're going to let the computer do the dirty work. We save our Y register because we'll need it again. When we JSR into BASIC ROM, the Y register will be altered by the routines in ROM. We have set aside a byte beyond our program proper to hold Y (see line 780). We put Y up there temporarily by STY Y.

location we've given the name LINELINK (160). We want to now adjust the PF pointer so that it knows the location of the start (the link bytes) of the second line. Since the Y register has been raised each time we POKEd something into the BASIC line we were building, Y now holds the distance between the previous and the new line. All we need to do is add Y to PF (610) and we're all set. Now PF points to the second line. This is what we've been waiting for. *Now* we know where the second line starts so we are prepared to POKE in the line link back at the start of the first line. We do just that in line 660 and the first line is complete.

All that's left is to see if we've reached the ending address of the ML program we're translating (700). If not, we branch to BACK, which just bounces us up to NEXTLINE, and we start the main loop all over again and build another BASIC line.

If we have finished, we store three zeros at the end of the BASIC program to tell BASIC emphatically that this is where the program ends. We add Y to PF again to get the actual ending address and store that into VARS, a location in RAM where the computer checks to see where a BASIC program ends (and, thus, where it can start storing variables during a BASIC program RUN). Finally we slip quietly back to BASIC mode through a gentle entryway in the ROM chips which doesn't erase the BASIC program or do anything else destructive.

Program 1: Datastuffer—Source Code

```
100 *= $C000;   ($5000 VIC)
110 .O
120 ; 64 VERSION  DATASTUFFER
130 ;----LABEL DEFINITIONS----------
140 ;
150 PF = $A3; CURRENT POSITION WITHIN BAS
    IC PROGRAM BEING CREATED
160 LINELINK = $A5;   HOLDER FOR POINTER
    {SPACE}IN BASIC ADDRESS
170 PC = $A7;   CURRENT POSITION WITHIN T
    HE ML TO BE FIXED
180 EADDR = $A9; HOLDER FOR TOP OF ML PRO
    GRAM BEING CONVERTED
200 INTAFP = $B391; TRANSLATES INTEGER TO
     FP FORMAT  ($D391 VIC)
210 INTASCII = $BDDD;TRANSLATES FP TO ASC
    II FORMAT   ($DDDD VIC)
215 WARM = $E37B;      ($E467 VIC)
220 BASIC = $0800;   WHERE BASIC STARTS I
    N RAM   ($1200 EXPANDED VIC)
225 VARS = 45; WHERE BASIC TEXT ENDS.
230 ;
240 ;----PRELIMINARIES--------------
250 ;
270 LDA #<BASIC:STA PF:LDA #>BASIC:STA PF
    +1; SET UP START OF BASIC
280 LDA #$50:STA LINENUM:LDA #$C3:STA LIN
    ENUM+1; START AT LINE 50000
290 LDA #0:STA COUNTER
300 TAY:STA (PF),Y; PUT ZERO BYTE (AT STA
    RT OF BASIC)
310 INC PF; ADJUST POINTER TO JUST PAST 0
     BYTE
320 ;
330 ;*  STORE LINE NUMBER AND DATA TOKEN
340 ;
350 NEXTLINE INY:INY; RAISE PF BY 2 TO GO
     PAST LINK
360 LDA LINENUM:STA (PF),Y; STORE LINE NU
    MBER LOW BYTE
370 INY:LDA LINENUM+1:STA (PF),Y; STORE L
    INE NUMBER HIGH BYTE
380 CLC:LDA LINENUM:ADC #10:STA LINENUM;
    {SPACE}RAISE LINE NUMBER BY 10
390 LDA LINENUM+1:ADC #0:STA LINENUM+1
400 INY:LDA #$83:STA (PF),Y:INY; STORE DA
    TA TOKEN
410 ;
420 ;*  TRANSLATE ML PROG. BYTE INTO ASCI
    I CHARS.
430 ;
440 DOMORE STY Y;SAVE Y
450 LDY #0:LDA (PC),Y:TAY;  GET BYTE OF M
    L
460 LDA #0; SET UP FOR ROM ROUTINES
470 JSR INTAFP:JSR INTASCII; TURN ML # IN
    TO ASCII
480 LDX #1:LDY Y:LOOP LDA $100,X:BEQ MORE
    :STA (PF),Y:INY:INX:JMP LOOP
490 ;
500 ;*  STORE COMMA, RAISE ML PROG. POINT
    ER
510 ;
520 MORE INC COUNTER
530 LDA #$2C:STA (PF),Y:INY; STORE A COMM
    A
540 INC PC:BNE GOON:INC PC+1; RAISE ML PO
    INTER
550 GOON LDA COUNTER:CMP #10:BEQ NEWLINE:
    JMP DOMORE; ONLY ALLOW 10 DATA ITEMS
560 ;
570 ;*  PREPARE FOR A NEW LINE OF DATA
580 ;
590 NEWLINE DEY:LDA #0:STA (PF),Y:STA COU
    NTER; STORE END OF LINE 0/FIX COUNTER
600 LDA PF:STA LINELINK:LDA PF+1:STA LINE
    LINK+1; SAVE LINK ADDR
610 INY:STY Y:CLC:LDA PF:ADC Y:STA PF
620 LDA #0:ADC PF+1;      ADD Y OFFSET TO
     CURRENT BASIC PROG POINTER
630 STA PF+1
640 ;  *PF NOW POINTS TO THE LINE LINK OF
     FOLLOWING LINE
650 ;  *SO PUNCH LINELINK POINTER INTO BA
    SIC
660 LDY #1:STA (LINELINK),Y:DEY:LDA PF:ST
    A (LINELINK),Y
670 ;
680 ;*  SEE IF WE'RE AT THE TOP OF THE ML
690 ;
700 SEC:LDA EADDR:SBC PC:STA 2:LDA EADDR+
    1:SBC PC+1:ORA 2
710 BCS BACK:LDA #0:DEY:STA (PF),Y
720 INY:STA (PF),Y:INY:STA (PF),Y
725 SEC:TYA:ADC PF:STA VARS:LDA #0:ADC PF
    +1:STA VARS+1:JMP WARM; END PROG.
730 BACK JMP NEXTLINE;   CONTINUE WITH NE
    XT LINE OF BASIC
740 ;
750 ;----STORAGE & DATA TABLES----------
760 ;
770 LINENUM .BYTE 0 0; HOLDS CURRENT LINE
     NUMBER
780 Y .BYTE 0;  TEMPORARY HOLDING PLACE F
    OR Y
790 COUNTER .BYTE 0;   KEEPS COUNT OF DAT
    A STATEMENTS PER BASIC LINE
```

How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the VIC-20, Commodore 64, Plus 4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. Also, carefully read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We publish two programs, appearing in alternating months, designed to make your typing effort easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then back on, erasing whatever was in memory. So be sure to *save a copy of your program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

The Automatic Proofreader

"The Automatic Proofreader" will help you type in program listings from COMPUTE!'s GAZETTE without typing mistakes. It is a short error-checking program that hides itself in memory. When activated, it lets you know immediately after typing a line from a program listing if you have made a mistake. Please read these instructions carefully before typing any programs in COMPUTE!'s GAZETTE.

Preparing The Proofreader

1. Using the listing below, type in the Proofreader. The same program works on both the VIC-20 and Commodore 64. Be very careful when entering the DATA statements—don't type an l instead of a 1, an O instead of a 0, extra commas, etc.

2. Save the Proofreader on tape or disk at least twice *before running it for the first time.* This is very important because the Proofreader erases this part of itself when you first type RUN.

3. After the Proofreader is saved, type RUN. It will check itself for typing errors in the DATA statements and warn you if there's a mistake. Correct any errors and save the corrected version. Keep a copy in a safe place—you'll need it again and again, every time you enter a program from COMPUTE's GAZETTE.

4. When a correct version of the Proofreader is run, it activates itself. You are now ready to enter a program listing. If you press RUN/STOP—RESTORE, the Proofreader is disabled. To reactivate it, just type the command SYS 886 and press RETURN.

Using The Proofreader

All VIC and 64 listings in COMPUTE!'s GAZETTE now have a *checksum number* appended to the end of each line, for example ":rem 123". *Don't enter this statement when typing in a program.* It is just for your information. The rem makes the number harmless if someone does type it in. It will, however, use up memory if you enter it, and it will confuse the Proofreader, even if you entered the rest of the line correctly.

When you type in a line from a program listing and press RETURN, the Proofreader displays a number at the top of your screen. *This checksum number must match the checksum number in the printed listing.* If it doesn't, it means you typed the line differently than the way it is listed. Immediately recheck your typing. Remember, don't type the rem statement with the checksum number; it is published only so you can check it against the number which appears on your screen.

The Proofreader is not picky with spaces. It will not notice extra spaces or missing ones. This is for your convenience, since spacing is generally not important. But occasionally proper spacing *is* important, so be extra careful with spaces, since the Proofreader will catch practically everything else that can go wrong.

There's another thing to watch out for: if you enter the line by using abbreviations for commands, the checksum will not match up. But there is a way to make the Proofreader check it. After entering the line, LIST it. This eliminates the abbreviations. Then move the cursor up to the line and press RETURN. It should now match the checksum. You can check whole groups of lines this way.

Special Tape SAVE Instructions

When you're done typing a listing, you must disable the Proofreader before saving the program on tape. Disable the Proofreader by pressing RUN/STOP–RESTORE (hold down the RUN/STOP key and sharply hit the RESTORE key). This procedure is not necessary for disk SAVEs, *but you must disable the Proofreader this way before a tape SAVE.*

SAVE to tape erases the Proofreader from memory, so you'll have to load and run it again if you want to type another listing. SAVE to disk does not erase the Proofreader.

Since the Proofreader is a machine language program stored in the cassette buffer, it will be erased during a tape SAVE or LOAD. If you intend to type in a program in more than one sitting or wish to make a safety SAVE, follow this procedure:

1. **Load and run the Proofreader.**
2. **Disable it by pressing RUN/STOP–RESTORE.**
3. **Type the following two lines in direct mode (without line numbers):**

```
A$="PROOFREADER.T":FORX=1TO40:A$=
A$+" ":NEXT
FORX=886TO1018:A$=A$+CHR$(PEEK(X)
):NEXT:OPEN1,1,1,A$:CLOSE1
```

After you type the last line, you will be asked to press RECORD and PLAY. We recommend you start at the beginning of a new tape.

You now have a new version of the Proofreader (PROOFREADER.T, as renamed in the above code). Turn your computer off and on, then load the program you were working on. Put the cassette containing PROOFREADER.T into the tape unit and type:

```
OPEN1:CLOSE1
```

You can now get into the Proofreader by typing SYS 886. To test this, PRINT PEEK (886) should return the number 173. If it does not, repeat the steps above, making sure that A$ (PROOFREADER.T) contains 13 characters.

The new version of Automatic Proofreader will load itself into the cassette buffer whenever you type OPEN1: CLOSE1 and PROOFREADER.T is the next program on your tape. It will not disturb the contents of BASIC memory.

The above code converts the machine language program into characters that are concatenated into a string. When you open a tape file, using the string as the name of the file, the tape header contains the machine language program (disguised as part of the filename). Opening and closing the tape file loads the header into the cassette buffer, but does not disturb BASIC programs already in memory.

Automatic Proofreader For VIC And 64

```
10 PRINT"{CLR}PLEASE WAIT...":FOR
   I=886TO1018:READA:CK=CK+A:POKE
   I,A:NEXT
20 IF CK<>17539 THEN PRINT"{DOWN}
   YOU MADE AN ERROR":PRINT"IN DA
   TA STATEMENTS.":END
30 SYS886:PRINT"{CLR}{2 DOWN}PROO
   FREADER ACTIVATED.":NEW
40 DATA 173,036,003,201,150,208
50 DATA 001,096,141,151,003,173
60 DATA 037,003,141,152,003,169
70 DATA 150,141,036,003,169,003
80 DATA 141,037,003,169,000,133
90 DATA 254,096,032,087,241,133
100 DATA 251,134,252,132,253,008
110 DATA 201,013,240,017,201,032
120 DATA 240,005,024,101,254,133
130 DATA 254,165,251,166,252,164
140 DATA 253,040,096,169,013,032
150 DATA 210,255,165,214,141,251
160 DATA 003,206,251,003,169,000
170 DATA 133,216,169,019,032,210
180 DATA 255,169,018,032,210,255
190 DATA 169,058,032,210,255,166
200 DATA 254,169,000,133,254,172
210 DATA 151,003,192,087,208,006
220 DATA 032,205,189,076,235,003
230 DATA 032,205,221,169,032,032
240 DATA 210,255,032,210,255,173
250 DATA 251,003,133,214,076,173
260 DATA 003
```

MLX Machine Language Entry Program For Commodore 64

Charles Brannon, Program Editor

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COMPUTE!'s GAZETTE. You need to know nothing about machine language to use MLX—it was designed for everyone.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file. You can then use the LOAD command to read the program into the computer, as with any program:

```
LOAD "filename",1,1 (for tape)
LOAD "filename",8,1 (for disk)
```

To start the program, you enter a SYS command that transfers control from BASIC to machine language.The starting SYS number always appears in the appropriate article.

Using MLX

Type in and save MLX (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX asks you for two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program.

You'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a *checksum number*. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the INST/DEL key; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter less than three digits, you can press either the SPACE bar or RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

To simplify your typing, MLX redefines part of the keyboard as a numeric keypad:

```
  U I O              7 8 9
H J K L  become   0  4 5 6
  M , .              1 2 3
```

MLX Commands

When you finish typing an ML listing (assuming you type it all in one session) you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you've made a typo when entering the MLX program itself.

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later.

MLX recognizes these commands:

SHIFT-S: Save SHIFT-N: New Address
SHIFT-L: Load SHIFT-D: Display

When you enter a command, MLX jumps out of the line you've been typing, so we recommend you do it at a new prompt. Use the Save command to save what you've been working on. It will save on tape or disk, as if you've finished, but the tape or disk won't work, of course, until you finish the typing. Remember what address you stop at. The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press SHIFT-L to reload the partly completed file into memory. Then use the New Address command to resume typing.

To use the New Address command, press SHIFT-N and enter the address where you previously stopped. The prompt will change, and you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the special listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

What if you forgot where you stopped typing? Use the Display command to scan memory from the beginning to the end of the program. When you reach the end of your typing, the lines will contain a random pattern of numbers. When you see the end of your typing, press any key to stop the listing. Use the New Address command to continue typing from the proper location.

See program listing on page 123.

MLX: 64 Version

(Article on page 122.)

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
10 REM LINES CHANGED FROM MLX
   {SPACE}VERSION 2.00 ARE 750
   ,765,770 AND 860      :rem 50
20 REM LINE CHANGED FROM MLX V
   ERSION 2.01 IS 300 :rem 147
100 PRINT"{CLR}{6}";CHR$(142);
   CHR$(8);:POKE53281,1:POKE5
   3280,1                :rem 67
101 POKE 788,52:REM DISABLE RU
   N/STOP                :rem 119
110 PRINT"{RVS}{39 SPACES}";
                         :rem 176
120 PRINT"{RVS}{14 SPACES}
   {RIGHT}{OFF}{*}£{RVS}
   {RIGHT} {RIGHT}{2 SPACES}
   {*}{OFF}{*}£{RVS}£{RVS}
   {14 SPACES}";         :rem 250
130 PRINT"{RVS}{14 SPACES}
   {RIGHT} {G}{RIGHT}
   {2 RIGHT} {OFF}£{RVS}£
   {*}{OFF}{*}{RVS}
   {14 SPACES}";         :rem 35
140 PRINT"{RVS}{41 SPACES}"
                         :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} M
   ACHINE LANGUAGE EDITOR VER
   SION 2.02{5 DOWN}":rem 238
210 PRINT"{5}{2 UP}STARTING AD
   DRESS?{8 SPACES}{9 LEFT}";
                         :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+11
   9*F)                  :rem 166
220 IFS<256OR(S>40960ANDS<4915
   2)ORS>53247THENGOSUB3000:G
   OTO210                :rem 235
225 PRINT:PRINT:PRINT :rem 180
230 PRINT"{5}{2 UP}ENDING ADDR
   ESS?{8 SPACES}{9 LEFT}";:I
   NPUTE:F=1-F:C$=CHR$(31+119
   *F)                   :rem 20
240 IFE<256OR(E>40960ANDE<4915
   2)ORE>53247THENGOSUB3000:G
   OTO230                :rem 183
250 IFE<STHENPRINTC$;"{RVS}END
   ING < START{2 SPACES}":GOS
   UB1000:GOTO 230       :rem 176
260 PRINT:PRINT:PRINT :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S
                         :rem 56
310 A=1:PRINTRIGHT$("0000"+MID
   $(STR$(AD),2),5);":";
                         :rem 33
315 FORJ=ATO6            :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:G
   OTO320                :rem 228
390 IFN=-211THEN 710     :rem 62
400 IFN=-204THEN 790     :rem 64
410 IFN=-206THENPRINT:INPUT"
   {DOWN}ENTER NEW ADDRESS";Z
   Z                     :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETH
   ENPRINT"{RVS}OUT OF RANGE"
   :GOSUB1000:GOTO410:rem 225
417 IFN=-206THENAD=ZZ:PRINT:GO
   TO310                 :rem 238
420 IF N<>-196 THEN 480
                         :rem 133
430 PRINT:INPUT"DISPLAY:FROM";
   F:PRINT,"TO";:INPUTT
                         :rem 234
440 IFF<SORF>EORT<SORT>ETHENPR
   INT"AT LEAST";S;"{LEFT}, N
   OT MORE THAN";E:GOTO430
                         :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINT
   RIGHT$("0000"+MID$(STR$(I)
   ,2),5);":";           :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRIN
   TRIGHT$("00"+MID$(STR$(N),
   2),3);",";            :rem 66
460 GETA$:IFA$>""THENPRINT:PRI
   NT:GOTO310            :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI
   :PRINT:PRINT:GOTO310
                         :rem 50
480 IFN<0 THEN PRINT:GOTO310
                         :rem 168
490 A(J)=N:NEXTJ         :rem 199
500 CKSUM=AD-INT(AD/256)*256:F
   ORI=1TO6:CKSUM=(CKSUM+A(I)
   )AND255:NEXT          :rem 200
510 PRINTCHR$(18);:GOSUB570:PR
   INTCHR$(146);         :rem 94
511 IFN=-1THENA=6:GOTO315
                         :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHE
   N530                  :rem 122
520 PRINT:PRINT"LINE ENTERED W
   RONG : RE-ENTER":PRINT:GOS
   UB1000:GOTO310        :rem 176
530 GOSUB2000            :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):
   NEXT:POKE54272,0:POKE54273
   ,0                    :rem 227
550 AD=AD+6:IF AD<E THEN 310
                         :rem 212
560 GOTO 710             :rem 108
570 N=0:Z=0              :rem 88
580 PRINT"{£}";          :rem 81
581 GETA$:IFA$=""THEN581
                         :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*
   (A$=".")-4*(A$="J")-5*(A$=
   "K")-6*(A$="L")       :rem 41
583 AV=AV-7*(A$="U")-8*(A$="I"
   )-9*(A$="O"):IFA$="H"THENA
   $="0"                 :rem 134
584 IFAV>0THENA$=CHR$(48+AV)
                         :rem 134
585 PRINTCHR$(20);:A=ASC(A$):I
   FA=13ORA=44ORA=32THEN670
                         :rem 229
590 IFA>128THENN=-A:RETURN
                         :rem 137
600 IFA<>20 THEN 630     :rem 10
610 GOSUB690:IFI=1ANDT=44THENN
   =-1:PRINT"{OFF}{LEFT}
   {LEFT}";:GOTO690      :rem 62
620 GOTO570              :rem 109
630 IFA<48ORA>57THEN580
                         :rem 105
640 PRINTA$;:N=N*10+A-48
                         :rem 106
650 IFN>255 THEN A=20:GOSUB100
   0:GOTO600             :rem 229
660 Z=Z+1:IFZ<3THEN580   :rem 71
670 IFZ=0THENGOSUB1000:GOTO570
                         :rem 114
680 PRINT",";:RETURN     :rem 240
690 S%=PEEK(209)+256*PEEK(210)
   +PEEK(211)            :rem 149
691 FORI=1TO3:T=PEEK(S%-I)
                         :rem 67
695 IFT<>44ANDT<>58THENPOKES%-
   I,32:NEXT             :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1)
   ;:RETURN              :rem 7
710 PRINT"{CLR}{RVS}*** SAVE *
   **{3 DOWN}"           :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}
   RETURN{OFF} ALONE TO CANCE
   L SAVE){DOWN}"        :rem 106
720 F$="":INPUT"{DOWN} FILENAM
   E";F$:IFF$=""THENPRINT:PRI
   NT:GOTO310            :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T
   {OFF}APE OR {RVS}D{OFF}ISK
   : (T/D)"              :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"T
   HEN740                :rem 36
750 DV=1-7*(A$="D"):IFDV=8THEN
   F$="0:"+F$:OPEN15,8,15,"S"
   +F$:CLOSE15           :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK
   (54)-LEN(T$):POKE782,ZK/25
   6                     :rem 3
762 POKE781,ZK-PEEK(782)*256:P
   OKE780,LEN(T$):SYS65469
                         :rem 109
763 POKE780,1:POKE781,DV:POKE7
   82,1:SYS65466         :rem 69
765 K=S:POKE254,K/256:POKE253,
   K-PEEK(254)*256:POKE780,25
   3                     :rem 17
766 K=E+1:POKE782,K/256:POKE78
   1,K-PEEK(782)*256:SYS65496
                         :rem 235
770 IF(PEEK(783)AND1)OR(191AND
   ST)THEN780            :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":G
   OTO310                :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.
   {2 SPACES}TRY AGAIN.":IFDV
   =1THEN720             :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E
   2$:PRINTE1$;E2$:CLOSE15:GO
   TO720                 :rem 103
790 PRINT"{CLR}{RVS}*** LOAD *
   **{2 DOWN}"           :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}
   RETURN{OFF} ALONE TO CANCE
   L LOAD)"              :rem 82
800 F$="":INPUT"{2 DOWN} FILEN
   AME";F$:IFF$=""THENPRINT:G
   OTO310                :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T
   {OFF}APE OR {RVS}D{OFF}ISK
   : (T/D)"              :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"T
   HEN820                :rem 34
830 DV=1-7*(A$="D"):IFDV=8THEN
   F$="0:"+F$            :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK
   (54)-LEN(T$):POKE782,ZK/25
   6                     :rem 2
841 POKE781,ZK-PEEK(782)*256:P
   OKE780,LEN(T$):SYS65469
                         :rem 107
845 POKE780,1:POKE781,DV:POKE7
   82,1:SYS65466         :rem 70
850 POKE780,0:SYS65493 :rem 11
860 IF(PEEK(783)AND1)OR(191AND
   ST)THEN870            :rem 111
865 PRINT"{DOWN}DONE.":GOTO310
                         :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.
   {2 SPACES}TRY AGAIN.{DOWN}
   ":IFDV=1THEN800       :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E
   2$:PRINTE1$;E2$:CLOSE15:GO
   TO800                 :rem 102
1000 REM BUZZER          :rem 135
1001 POKE54296,15:POKE54277,45
   :POKE54278,165        :rem 207
1002 POKE54276,33:POKE 54273,6
   :POKE54272,5          :rem 42
1003 FORT=1TO200:NEXT:POKE5427
   6,32:POKE54273,0:POKE5427
   2,0:RETURN            :rem 202
2000 REM BELL SOUND      :rem 78
2001 POKE54296,15:POKE54277,0:
   POKE54278,247         :rem 152
2002 POKE 54276,17:POKE54273,4
   0:POKE54272,0         :rem 86
```

```
2003 FORT=1TO100:NEXT:POKE5427
     6,16:RETURN          :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PA
     GE OR ROM":GOTO1000
                          :rem 89
```

Automatic Syntax Checker

(See instructions in article on page 104 before typing in.)

```
2049 :047,008,000,000,158,050,008
2055 :048,057,055,058,143,034,146
2061 :020,020,020,020,020,034,147
2067 :020,032,018,067,072,069,041
2073 :067,075,069,082,032,086,180
2079 :049,032,080,072,073,076,157
2085 :073,080,032,078,069,076,189
2091 :083,079,078,000,000,000,027
2097 :169,079,133,095,169,008,190
2103 :133,096,169,191,133,090,099
2109 :169,011,133,091,169,112,234
2115 :133,088,169,195,133,089,106
2121 :032,191,163,076,000,192,215
2127 :173,002,003,201,071,208,225
2133 :022,162,009,189,101,195,251
2139 :157,002,003,202,016,247,206
2145 :169,084,160,195,032,030,255
2151 :171,032,015,195,096,162,006
2157 :009,189,002,003,157,101,058
2163 :195,202,016,247,169,071,247
2169 :141,002,003,169,194,141,003
2175 :003,003,169,000,133,251,174
2181 :133,253,169,160,133,252,209
2187 :169,224,133,254,160,000,055
2193 :177,251,145,251,177,253,119
2199 :145,253,200,208,245,165,087
2205 :252,201,192,176,007,230,191
2211 :252,230,254,076,064,192,207
2217 :169,071,160,195,032,030,058
2223 :171,169,054,162,171,141,019
2229 :012,160,142,013,160,141,041
2235 :036,160,142,037,160,141,095
2241 :040,160,142,041,160,141,109
2247 :044,160,142,045,160,141,123
2253 :064,160,142,065,160,141,169
2259 :068,160,142,069,160,141,183
2265 :080,160,142,081,160,162,234
2271 :000,169,088,157,082,160,111
2277 :169,188,157,083,160,232,194
2283 :232,224,028,208,240,169,056
2289 :173,141,112,160,141,118,062
2295 :160,169,183,141,113,160,149
2301 :141,119,160,169,036,141,251
2307 :018,187,169,169,141,083,002
2313 :184,169,000,141,084,184,003
2319 :169,133,141,085,184,169,128
2325 :097,141,086,184,169,096,026
2331 :141,087,184,169,044,141,025
2337 :071,171,169,240,141,113,170
2343 :168,169,003,141,114,168,034
2349 :169,032,141,115,168,169,071
2355 :107,141,116,168,169,169,153
2361 :141,117,168,169,096,141,121
2367 :118,168,141,039,184,141,086
2373 :163,168,141,045,225,141,184
2379 :187,166,141,060,184,141,186
2385 :131,170,141,193,225,141,058
2391 :202,225,141,111,225,141,108
2397 :089,225,169,076,141,131,156
2403 :168,169,160,141,132,168,013
2409 :169,168,141,133,168,169,029
2415 :158,141,088,160,169,179,238
2421 :141,089,160,169,183,141,232
2427 :093,169,169,194,141,094,215
2433 :169,169,076,141,055,169,140
2439 :169,064,141,056,169,169,135
2445 :169,141,057,169,169,183,005
2451 :141,073,169,169,194,141,010
2457 :074,169,169,076,141,076,090
2463 :167,169,087,141,077,167,199
2469 :169,167,141,078,167,169,032
2475 :076,141,120,167,169,146,222
2481 :141,121,167,169,167,141,059
2487 :122,167,169,076,141,159,249
2493 :167,169,132,141,160,167,101
2499 :169,194,141,161,167,169,172
2505 :076,141,039,173,169,125,156
2511 :141,040,173,169,173,141,020
2517 :041,173,169,076,141,117,162
2523 :173,169,132,141,118,173,101
2529 :169,194,141,119,173,169,166
2535 :076,141,144,170,169,151,058
2541 :141,145,170,169,170,141,149
2547 :146,170,169,076,141,006,183
2553 :172,169,021,141,007,172,163
2559 :169,172,141,008,172,162,055
2565 :000,189,042,195,201,255,119
2571 :240,006,157,024,172,232,074
2577 :208,243,169,234,141,123,111
2583 :171,141,124,171,141,125,128
2589 :171,169,011,141,129,171,053
2595 :169,076,141,141,171,169,134
2601 :006,141,142,171,169,172,074
2607 :141,143,171,169,182,141,226
2613 :207,171,169,163,141,208,088
2619 :171,169,076,141,209,171,228
2625 :169,006,141,210,171,169,163
2631 :172,141,211,171,169,076,243
2637 :141,173,171,169,006,141,110
2643 :174,171,169,172,141,175,061
2649 :171,169,076,141,252,178,052
2655 :169,015,141,253,178,169,252
2661 :179,141,254,178,169,036,034
2667 :141,075,183,169,044,141,092
2673 :182,179,162,000,189,063,120
2679 :195,201,255,240,007,157,150
2685 :247,179,232,076,038,194,067
2691 :173,097,195,208,008,169,213
2697 :001,141,097,195,032,068,159
2703 :166,032,096,166,076,157,068
2709 :227,032,096,165,134,122,157
2715 :132,123,032,115,000,170,215
2721 :240,243,162,255,134,058,229
2727 :144,009,032,015,195,032,082
2733 :121,165,076,228,167,032,194
2739 :107,169,032,121,165,140,145
2745 :098,195,165,020,141,099,135
2751 :195,165,021,141,100,195,240
2757 :032,244,194,169,255,133,200
2763 :122,169,001,133,123,076,059
2769 :140,194,160,000,177,122,234
2775 :240,014,208,065,032,099,105
2781 :166,032,115,000,032,174,228
2787 :194,076,132,194,032,015,102
2793 :195,173,099,195,133,020,024
2799 :173,100,195,133,021,032,125
2805 :096,166,172,098,195,076,024
2811 :162,164,201,000,240,026,020
2817 :201,058,240,214,056,233,235
2823 :128,144,028,201,035,176,207
2829 :030,010,168,185,013,160,067
2835 :072,185,012,160,072,076,084
2841 :115,000,096,201,058,240,223
2847 :187,032,015,195,076,008,032
2853 :175,032,165,169,076,132,018
2859 :194,201,075,208,009,032,250
2865 :115,000,169,164,032,255,016
2871 :174,096,138,072,032,015,070
2877 :195,104,170,108,000,003,129
2883 :120,169,140,141,008,003,136
2889 :169,194,141,009,003,169,246
2895 :234,141,000,003,169,194,052
2901 :141,001,003,169,053,133,073
2907 :001,088,096,120,169,228,025
2913 :141,008,003,169,167,141,214
2919 :009,003,169,139,141,000,052
2925 :003,169,227,141,001,003,141
2931 :169,055,133,001,088,096,145
2937 :032,121,000,240,008,201,211
2943 :058,240,004,201,044,240,146
2949 :001,096,032,115,000,076,197
2955 :021,172,255,032,241,174,010
2961 :032,141,173,096,255,018,092
2967 :067,072,069,067,075,069,058
2973 :082,032,079,078,032,000,204
2979 :018,067,072,069,067,075,019
2985 :069,082,032,079,070,070,059
2991 :000,000,000,000,000,131,050
2997 :164,124,165,026,167,228,031
3003 :167,134,174,013,013,013,189
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Turnabout

(See instructions in article on page 50 before typing in.)

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49152 :169,002,141,178,002,169,149
49158 :000,141,179,002,141,180,137
49164 :002,141,181,002,169,001,252
49170 :141,183,002,169,003,141,145
49176 :182,002,032,209,200,169,050
49182 :200,141,169,002,032,198,004
49188 :192,032,113,194,032,101,188
49194 :200,162,023,160,015,024,114
49200 :032,240,255,169,062,160,198
49206 :201,032,030,171,173,000,149
49212 :220,041,016,208,249,160,186
49218 :018,169,032,153,194,005,125
49224 :136,016,248,206,060,003,229
49230 :208,015,173,061,003,141,167
49236 :060,003,032,161,193,032,053
49242 :157,192,032,101,200,206,210
49248 :168,002,208,012,173,169,060
49254 :002,141,168,002,032,135,070
49260 :196,136,208,253,173,141,191
49266 :002,208,251,032,225,198,006
49272 :174,202,002,202,208,253,137
49278 :238,200,002,173,200,002,173
49284 :201,015,208,012,201,008,009
49290 :208,008,173,126,192,073,150
49296 :032,141,126,192,173,200,240
49302 :002,141,008,212,076,075,152
49308 :192,206,201,002,208,035,232
49314 :169,006,141,201,002,206,119
49320 :060,201,173,060,201,201,040
49326 :255,208,020,206,061,201,101
49332 :201,255,208,013,169,000,002
49338 :141,061,201,141,060,201,223
49344 :169,050,141,202,002,096,084
49350 :169,100,141,202,002,169,213
49356 :006,141,201,002,169,147,102
49362 :032,210,255,169,030,032,170
49368 :210,255,169,000,141,033,000
49374 :208,141,032,208,169,021,233
49380 :133,002,160,000,032,067,110
49386 :193,160,039,032,067,193,150
49392 :198,002,016,242,169,021,120
49398 :133,002,160,000,166,002,197
49404 :024,032,240,255,165,002,202
49410 :240,014,201,021,240,010,216
49416 :169,120,160,193,032,030,200
49422 :171,076,025,193,169,079,215
49428 :160,193,032,030,171,198,036
49434 :002,198,002,198,002,016,188
49440 :215,162,022,160,000,024,103
49446 :032,240,255,162,040,169,168
49452 :160,032,210,255,202,208,087
49458 :250,162,022,160,000,024,156
49464 :032,240,255,169,028,160,172
49470 :200,032,030,171,096,166,245
49476 :002,024,032,240,255,169,022
49482 :194,032,210,255,096,209,046
49488 :195,195,209,195,195,209,254
49494 :195,195,209,195,195,209,004
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49506 :195,195,209,195,195,209,016
49512 :195,195,209,195,195,209,022
49518 :195,195,209,195,195,209,028
49524 :195,195,209,000,209,195,095
49530 :195,209,032,032,209,195,226
49536 :195,209,032,032,209,195,232
49542 :195,209,032,032,209,195,238
49548 :195,209,032,032,209,195,244
49554 :195,209,032,032,209,195,250
49560 :195,209,032,032,209,195,000
49566 :195,209,000,165,249,133,085
49572 :247,165,250,133,248,160,087
49578 :082,173,000,220,041,031,205
49584 :201,031,208,003,076,076,003
49590 :194,169,032,145,005,173,132
49596 :000,220,074,176,012,198,100
49602 :248,169,001,133,252,133,106
49608 :144,162,040,208,064,074,124
49614 :176,012,230,248,169,000,017
49620 :133,252,133,144,162,040,052
49626 :208,034,074,176,014,198,154
49632 :247,169,002,133,144,169,064
49638 :000,133,251,162,001,208,217
49644 :032,074,176,092,230,247,063
49650 :169,003,133,144,169,001,093
49656 :133,251,162,001,208,000,235
49662 :138,024,101,005,133,003,146
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49668 :165,006,105,000,133,004,161
49674 :076,028,194,134,002,165,097
49680 :005,056,229,002,133,003,188
49686 :165,006,233,000,133,004,051
49692 :032,019,195,008,160,082,012
49698 :040,176,039,165,003,133,078
49704 :005,165,004,133,006,165,006
49710 :247,133,249,165,248,133,197
49716 :250,166,144,189,109,194,080
49722 :069,150,201,038,072,176,252
49728 :002,133,149,165,150,073,224
49734 :001,133,150,104,208,002,156
49740 :165,149,072,177,005,201,077
49746 :045,144,003,238,198,002,200
49752 :104,145,005,165,005,024,024
49758 :105,000,133,003,165,006,250
49764 :105,212,133,004,169,001,212
49770 :145,003,096,036,036,038,204
49776 :040,169,084,133,005,169,200
49782 :005,133,006,169,150,141,210
49788 :060,003,141,061,003,169,049
49794 :022,133,249,169,010,133,078
49800 :250,174,178,002,202,189,107
49806 :003,195,157,062,003,189,239
49812 :009,195,157,082,003,189,015
49818 :015,195,157,102,003,169,027
49824 :000,157,142,003,133,150,233
49830 :157,182,003,157,162,003,062
49836 :141,198,002,202,016,219,182
49842 :169,036,133,149,160,023,080
49848 :169,000,153,000,212,136,086
49854 :016,250,169,015,141,024,037
49860 :212,169,008,141,003,212,173
49866 :169,240,141,006,212,169,115
49872 :255,141,012,212,169,240,213
49878 :141,013,212,169,129,141,251
49884 :011,212,169,010,141,200,195
49890 :002,169,000,141,060,201,031
49896 :141,061,201,174,183,002,226
49902 :173,060,201,024,105,100,133
49908 :141,060,201,173,061,201,057
49914 :105,000,141,061,201,202,192
49920 :208,236,096,002,037,002,069
49926 :037,020,020,001,001,019,104
49932 :019,001,019,001,002,003,057
49938 :000,177,003,201,066,240,193
49944 :003,076,162,195,160,042,150
49950 :177,003,201,081,208,064,252
49956 :165,251,208,031,160,161,244
49962 :177,003,201,032,208,008,159
49968 :160,160,177,003,201,032,013
49974 :240,003,076,093,196,169,063
49980 :067,162,161,145,003,032,118
49986 :105,196,076,045,196,160,076
49992 :163,177,003,201,032,208,088
49998 :008,160,164,177,003,201,023
50004 :032,240,003,076,093,196,212
50010 :169,067,162,163,032,105,020
50016 :196,076,045,196,165,251,001
50022 :208,029,160,001,177,003,168
50028 :201,032,208,008,160,000,205
50034 :177,003,201,032,240,003,002
50040 :076,093,196,169,067,162,115
50046 :001,032,105,196,076,057,081
50052 :196,160,003,177,003,201,104
50058 :032,208,008,160,004,177,215
50064 :003,201,032,240,003,076,187
50070 :093,196,169,067,162,003,072
50076 :032,105,196,076,057,196,050
50082 :201,067,240,003,076,097,078
50088 :196,160,081,177,003,201,218
50094 :081,208,062,165,252,208,126
50100 :029,160,124,177,003,201,106
50106 :032,208,008,160,164,177,167
50112 :003,201,032,240,003,076,235
50118 :093,196,169,066,162,124,240
50124 :032,105,196,076,069,196,110
50130 :160,044,177,003,201,032,059
50136 :208,008,160,004,177,003,008
50142 :201,032,240,003,076,093,099
50148 :196,169,066,162,044,032,129
50154 :105,196,076,069,196,165,017
50160 :252,208,029,160,120,177,162
50166 :003,201,032,208,008,160,090
50172 :160,177,003,201,032,240,041
50178 :003,076,093,196,169,066,093
50184 :162,120,032,105,196,076,187
50190 :081,196,160,040,177,003,159
50196 :201,032,208,008,160,000,117
50202 :177,003,201,032,240,003,170
50208 :076,093,196,169,066,162,026
50214 :040,032,105,196,076,081,056
50220 :196,160,082,169,032,145,060
50226 :003,160,122,145,003,208,179
50232 :038,160,082,169,032,145,170
50238 :003,160,042,145,003,208,111
50244 :026,160,082,169,032,145,170
50250 :003,160,083,145,003,208,164
50256 :014,160,082,169,032,145,170
50262 :003,160,081,145,003,208,174
50268 :002,056,096,024,096,201,055
50274 :032,240,002,056,096,024,036
50280 :096,145,003,072,165,003,076
50286 :024,105,000,133,253,165,022
50292 :004,105,212,133,254,169,225
50298 :005,145,253,138,168,104,167
50304 :145,003,169,005,145,253,080
50310 :096,174,178,002,202,189,207
50316 :182,003,240,003,076,216,092
50322 :197,189,102,003,141,171,181
50328 :002,189,062,003,133,247,020
50334 :189,082,003,133,248,032,077
50340 :223,197,165,249,056,229,003
50346 :247,201,002,176,016,160,204
50352 :000,165,250,197,248,144,156
50358 :002,160,002,152,157,122,009
50364 :003,016,023,165,250,056,189
50370 :229,248,201,002,176,022,048
50376 :160,003,165,249,197,247,197
50382 :144,002,160,001,152,157,054
50388 :122,003,157,102,003,032,119
50394 :101,198,144,016,189,102,200
50400 :003,073,002,221,122,003,136
50406 :240,008,189,122,003,032,056
50412 :101,198,144,118,189,102,064
50418 :003,032,101,198,144,110,062
50424 :032,091,198,041,003,073,174
50430 :002,221,102,003,240,244,042
50436 :157,102,003,222,102,003,081
50442 :032,091,198,016,004,169,008
50448 :222,208,002,169,254,141,244
50454 :029,197,169,003,141,170,219
50460 :002,254,102,003,189,102,168
50466 :003,016,002,169,003,201,172
50472 :004,208,005,169,000,157,071
50478 :102,003,032,101,198,144,114
50484 :049,206,170,002,048,002,017
50490 :016,225,189,062,003,133,174
50496 :247,189,082,003,133,248,198
50502 :173,171,002,157,102,003,166
50508 :254,162,003,189,162,003,081
50514 :201,010,208,021,032,223,009
50520 :197,169,001,157,182,003,029
50526 :162,001,032,208,199,076,004
50532 :216,197,169,000,157,162,233
50538 :003,165,247,157,062,003,231
50544 :165,248,157,082,003,032,031
50550 :015,198,138,072,189,142,104
50556 :003,024,105,004,201,016,221
50562 :208,002,169,000,157,142,040
50568 :003,170,165,195,024,105,030
50574 :000,133,025,165,196,105,254
50580 :212,133,026,189,059,198,197
50586 :160,000,032,255,197,145,175
50592 :195,189,075,198,145,025,219
50598 :160,001,032,255,197,232,019
50604 :189,059,198,145,195,189,123
50610 :075,198,145,025,232,189,018
50616 :059,198,160,040,032,255,160
50622 :197,145,195,189,075,198,165
50628 :145,025,232,189,059,198,020
50634 :160,041,032,255,197,145,008
50640 :195,189,075,198,145,025,011
50646 :104,170,202,048,003,076,049
50652 :139,196,096,032,015,198,128
50658 :032,255,197,169,032,145,032
50664 :195,160,001,032,255,197,048
50670 :145,195,160,040,032,255,041
50676 :197,145,195,160,041,032,246
50682 :255,197,145,195,096,072,186
50688 :177,195,201,036,144,007,248
50694 :201,042,176,003,238,198,096
50700 :002,104,096,169,000,133,004
50706 :195,169,004,133,196,164,111
50712 :248,240,016,165,195,024,144
50718 :105,040,133,195,165,196,096
50724 :105,000,133,196,136,016,110
50730 :238,165,195,024,101,247,244
50736 :133,195,165,196,105,000,074
50742 :133,196,160,000,096,079,206
50748 :119,116,032,119,080,032,046
50754 :103,032,103,111,122,116,141
50760 :032,076,111,002,007,008,052
50766 :009,002,007,008,009,002,115
50772 :007,008,009,002,007,008,125
50778 :009,165,143,010,010,056,227
50784 :101,143,133,143,096,072,016
50790 :189,062,003,133,247,189,157
50796 :082,003,133,248,104,208,118
50802 :009,198,248,160,040,032,033
50808 :173,198,144,066,201,002,136
50814 :208,009,230,248,160,040,253
50820 :032,159,198,144,053,201,151
50826 :003,208,009,198,247,160,195
50832 :001,032,173,198,144,040,220
50838 :230,247,160,001,032,159,211
50844 :198,144,031,152,024,101,038
50850 :195,133,195,165,196,105,127
50856 :000,133,196,024,096,132,237
50862 :002,165,195,056,229,002,055
50868 :133,195,165,196,233,000,078
50874 :133,196,024,096,032,015,170
50880 :198,177,195,201,060,176,175
50886 :025,160,001,177,195,201,189
50892 :060,176,017,160,040,177,066
50898 :195,201,060,176,009,160,243
50904 :041,177,195,201,060,176,042
50910 :001,024,096,174,178,002,185
50916 :202,189,182,003,240,126,146
50922 :202,016,248,173,183,002,034
50928 :010,170,032,208,199,238,073
50934 :183,002,173,179,002,073,090
50940 :001,141,179,002,208,017,032
50946 :173,182,002,201,003,240,035
50952 :005,238,182,002,016,005,200
50958 :162,005,032,208,199,173,025
50964 :178,002,201,006,240,005,140
50970 :238,178,002,016,009,173,130
50976 :169,002,056,233,020,141,141
50982 :169,002,169,030,141,199,236
50988 :002,169,016,141,011,212,083
50994 :173,180,002,024,109,060,086
51000 :201,141,180,002,173,181,166
51006 :002,109,061,201,141,181,245
51012 :002,169,067,141,004,212,151
51018 :173,199,002,141,015,212,048
51024 :141,033,208,032,180,200,106
51030 :173,199,002,024,105,010,087
51036 :141,199,002,201,060,208,135
51042 :231,104,104,076,034,192,071
51048 :173,198,002,240,063,169,181
51054 :067,141,004,212,169,020,211
51060 :141,199,002,169,016,141,016
51066 :011,212,173,199,002,141,092
51072 :015,212,032,180,200,173,172
51078 :199,002,056,233,001,141,254
51084 :199,002,201,015,208,234,231
51090 :169,016,141,004,212,206,126
51096 :182,002,240,017,206,198,229
51102 :002,032,101,200,162,020,163
51108 :032,226,199,104,104,076,137
51114 :034,192,096,169,032,141,066
51120 :199,007,032,101,200,162,109
51126 :010,160,015,024,032,240,151
51132 :255,169,249,160,199,032,228
51138 :030,171,173,000,220,041,061
51144 :016,208,249,104,104,076,189
51150 :000,192,173,180,002,024,009
51156 :105,050,141,180,002,144,066
51162 :003,238,181,002,202,208,028
51168 :239,096,169,000,133,162,255
51174 :138,197,162,208,252,096,003
51180 :152,072,160,050,136,208,246
51186 :253,202,208,250,104,168,147
51192 :096,158,018,071,065,077,221
51198 :069,032,079,086,069,082,159
51204 :146,017,017,157,157,157,143
51210 :157,157,157,157,157,157,184
51216 :150,080,082,069,083,083,051
51222 :032,070,073,082,069,000,092
51228 :129,083,067,079,082,069,025
51234 :160,160,160,160,160,160,226
51240 :160,160,160,160,160,160,232
51246 :160,160,160,160,160,160,238
51252 :160,160,160,160,160,160,244
51258 :066,079,078,085,083,013,206
51264 :013,159,076,073,086,069,028
51270 :083,032,032,032,032,032,057
51276 :032,032,032,032,032,032,012
51282 :032,032,032,032,032,032,018
51288 :032,032,032,032,032,032,024
51294 :032,076,069,086,069,076,246
51300 :000,169,129,032,210,255,127
```

```
51306 :162,022,160,006,024,032,000
51312 :240,255,173,181,002,174,113
51318 :180,002,032,205,189,162,120
51324 :022,160,035,024,032,240,125
51330 :255,173,061,201,174,060,030
51336 :201,032,205,189,169,160,068
51342 :032,210,255,169,159,032,231
51348 :210,255,174,182,002,240,187
51354 :008,169,038,157,198,007,219
51360 :202,208,250,162,024,160,142
51366 :035,024,032,240,255,169,153
51372 :000,174,183,002,032,205,000
51378 :189,096,160,050,140,001,046
51384 :212,162,006,032,236,199,007
51390 :200,192,075,208,243,140,224
51396 :001,212,162,006,032,236,077
51402 :199,136,192,050,208,243,206
51408 :096,120,169,051,133,001,010
51414 :169,000,133,251,133,253,129
51420 :169,056,133,252,169,208,183
51426 :133,254,162,008,160,000,175
51432 :177,253,145,251,136,208,122
51438 :249,230,254,230,252,202,119
51444 :016,242,160,047,185,012,138
51450 :201,153,032,057,136,016,077
51456 :247,169,055,133,001,088,181
51462 :169,030,141,024,208,096,162
51468 :024,060,024,060,090,024,038
51474 :036,102,024,060,024,060,068
51480 :090,024,102,066,048,120,218
51486 :048,028,122,024,038,098,132
51492 :048,120,048,092,060,024,172
51498 :036,020,012,030,012,056,208
51504 :094,024,100,070,012,030,122
51510 :012,058,060,024,036,040,028
51516 :100,000,153,084,085,082,052
51522 :078,065,066,079,085,084,011
51528 :032,032,145,145,145,145,204
51534 :145,145,145,145,145,145,180
51540 :145,145,157,157,157,157,234
51546 :157,157,157,157,157,157,008
51552 :157,150,080,082,069,083,205
51558 :083,032,070,073,082,069,255
51564 :000,002,255,252,254,000,103
```

Power BASIC: USR Joystick Reader

(Article on page 94.)

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: USR Joystick Reader—64 Version

```
10 FORA=679TO743:READB:CH=CH+B
   :POKEA,B:NEXT:IFCH<>5899THE
   NPRINT"DATA ERROR":END
                          :rem 50
20 POKE785,167:POKE786,2:PRINT
   "{CLR}{DOWN}ACTIVATED"
                         :rem 175
30 DATA 32,247,183,165,20,201
                         :rem 136
40 DATA 3,176,26,73,3,170
                         :rem 200
50 DATA 1?89,255,219,41,15,133
                         :rem 151
60 DATA 2,169,15,56,229,2
                         :rem 206
70 DATA 170,189,221,2,168,169
                         :rem 157
80 DATA 0,32,145,179,96,160
                          :rem 52
90 DATA 0,41,1,170,189,0
                         :rem 143
100 DATA 220,41,16,208,1,200
                          :rem 68
110 DATA 169,0,32,145,179,96
                         :rem 103
120 DATA 0,1,3,0,4,8,7,0,2,5,6
                         :rem 153
```

Program 2: USR Joystick Reader—VIC Version

```
10 FORA=679TO766:READB:CH=CH+B
   :POKEA,B:NEXT:IFCH<>8799THE
   NPRINT"DATA ERROR":END
                          :rem 57
20 POKE1,167:POKE2,2:PRINT"
   {CLR}{DOWN}ACTIVATED"
                         :rem 201
30 DATA 32,247,215,165,20,74
                          :rem 92
40 DATA 144,53,169,0,141,19
                          :rem 43
50 DATA 145,169,127,141,34,145
                         :rem 198
60 DATA 173,32,145,74,74,41
                          :rem 49
70 DATA 32,133,251,173,17,145
                         :rem 142
80 DATA 41,28,5,251,74,74
                         :rem 208
90 DATA 41,15,133,251,169,15
                          :rem 95
100 DATA 56,229,251,170,189,24
    4                    :rem 251
110 DATA 2,168,169,0,32,145
                          :rem 40
120 DATA 211,169,255,141,34,14
    5                    :rem 240
130 DATA 96,160,0,173,17,145
                          :rem 93
140 DATA 41,32,208,1,200,169
                          :rem 82
150 DATA 0,32,145,211,96,0
                         :rem 238
160 DATA 1,3,0,4,8,7,0,2,5,6
                          :rem 65
```

Kaleidoscope

(Article on page 107.)

Program 1: Kaleidoscope—64 Version

```
10 FORI=0TO7:READM(I):NEXT:DAT
   A1,4,25,128,2,10,60,255
                          :rem 18
20 POKE53280,12:POKE53281,12:P
   RINT"{BLK}":GOSUB450:rem 11
30 REM * ML ROUTINE ADDRESSES
   {SPACE}*              :rem 248
40 KAL=49664:A=49696:CHAR=251:
   X=253:Y=254           :rem 81
50 SEED=KAL+126:POKESEED,255*R
   ND(-TI)+1:REM * SEED RANDOM
    # GEN *             :rem 135
60 POKESEED+1,256*RND(1):POKEX
   ,0:POKEY,0:POKECHAR,160:GOS
   UB270                 :rem 67
70 REM * INTRO PAGE *    :rem 72
80 PRINT"{CLR}{5 DOWN}
   {12 SPACES}WELCOME TO
   {2 DOWN}":PRINT"{10 SPACES}
   UCCCCCCCCCCCCI"       :rem 191
90 PRINT"{10 SPACES}-KALEIDOSC
   OPE-"                 :rem 103
100 PRINT"{10 SPACES}J********
    ****K{4 DOWN}":PRINT"
    {5 SPACES}HIT ANY KEY TO C
    ONTINUE"             :rem 4
110 GOSUB290:POKEA,25:GOTO330
                         :rem 243
120 REM * MAIN LOOP *    :rem 42
130 SYSKAL:FORI=1TOD:NEXT:GETA
    $:IFA$=""THEN130     :rem 148
140 V=VAL(A$):IFA$="0"THEND=1
                         :rem 129
150 IFV>0THEND=2.4↑V     :rem 225
160 IFA$="Q"THENEND      :rem 99
170 FORI=0TO7:IFA$=CHR$(133+I)
    THENPOKEA,M(I)       :rem 137
180 NEXTI:IFA$="B"THENGOSUB250
                          :rem 88
190 IFA$="C"THENGOSUB270
                         :rem 154
200 IFA$=CHR$(147)THENPRINTCHR
    $(147):GOTO130       :rem 98
210 IFA$="H"THEN330      :rem 21
220 IFA$=" "THENGOSUB290
                          :rem 83
230 GOTO130              :rem 98
240 REM * BLACK AND WHITE *
                         :rem 127
250 POKE49692,1:RETURN   :rem 75
260 REM * COLOR *        :rem 79
270 POKE49692,15:RETURN
                         :rem 130
280 REM * HIT ANY *      :rem 159
290 GETA$:IFA$<>""THEN290
                         :rem 150
300 GETA$:IFA$=""THEN300
                          :rem 73
310 RETURN               :rem 116
320 REM * HELP MESSAGE *
                         :rem 251
330 PRINT"{CLR}{3 SPACES}TO CO
    NTROL THE DISPLAY, TYPE TH
    ESE"                 :rem 156
340 PRINT"{3 SPACES}CHARACTERS
     WHILE THE KALEIDOSCOPE"
                          :rem 21
350 PRINT"{14 SPACES}IS RUNNIN
    G"                    :rem 38
360 PRINT"{2 DOWN}F1 THROUGH F
    8 : CONTROL COMPLEXITY
    {DOWN}"               :rem 28
370 PRINT" 0 THROUGH{2 SPACES}
    9 : CONTROL SPEED{DOWN}"
                         :rem 210
380 PRINT"{6 SPACES}B
    {7 SPACES}: BLACK AND WHIT
    E{DOWN}"             :rem 170
390 PRINT"{6 SPACES}C
    {7 SPACES}: 16 COLORS":PRI
    NT"{DOWN}{4 SPACES}SPACE
    {5 SPACES}: FREEZE DISPLAY
    "                    :rem 188
400 PRINT"{DOWN}{5 SPACES}CLR
    {6 SPACES}: CLEAR SCREEN":
    PRINT"{DOWN}{6 SPACES}H
    {7 SPACES}: HELP!":rem 160
410 PRINT"{DOWN}{6 SPACES}Q
    {7 SPACES}: QUIT{2 DOWN}"
                         :rem 103
420 PRINT" HIT ANY KEY TO STAR
    T THE KALEIDOSCOPE":GOSUB2
    90:PRINTCHR$(147)    :rem 172
430 GOTO130              :rem 100
440 REM * LOAD ML ROUTINES *
                          :rem 2
450 PRINTCHR$(147)"...LOADING
    {SPACE}ML"           :rem 121
460 S=0:C=49664:FORI=CTOC+248:
    READX:POKEI,X:S=S+X:NEXT
                         :rem 183
470 IFS<>33124THENPRINT"ERROR
    {SPACE}IN DATA STATEMENTS"
    :END                 :rem 72
480 RETURN               :rem 124
490 DATA 173,32,194,133,165,32
                         :rem 201
500 DATA 33,194,32,90,194,32
                          :rem 96
510 DATA 33,194,32,90,194,198
                         :rem 158
```

```
520 DATA 165,208,240,238,240,1
    93                    :rem 41
530 DATA 173,240,193,41,15,133
                          :rem 190
540 DATA 252,96,25,32,43,194
                          :rem 104
550 DATA 32,65,194,32,43,194
                          :rem 104
560 DATA 96,32,172,194,32,74
                          :rem 109
570 DATA 194,32,172,194,32,82
                          :rem 156
580 DATA 194,32,172,194,32,74
                          :rem 158
590 DATA 194,32,172,194,96,165
                          :rem 218
600 DATA 253,164,254,133,254,1
    32                    :rem 36
610 DATA 253,96,169,24,56,229
                          :rem 164
620 DATA 253,133,253,96,169,24
                          :rem 206
630 DATA 56,229,254,133,254,96
                          :rem 211
640 DATA 32,109,194,144,7,32
                          :rem 98
650 DATA 109,194,144,28,176,35
                          :rem 210
660 DATA 32,109,194,144,43,176
                          :rem 205
670 DATA 50,14,127,194,46,126
                          :rem 152
680 DATA 194,144,8,173,127,194
                          :rem 214
690 DATA 73,45,141,127,194,96
                          :rem 165
700 DATA 109,12,198,253,16,4
                          :rem 97
710 DATA 169,24,133,253,96,230
                          :rem 201
720 DATA 253,165,253,201,25,20
    8                     :rem 243
730 DATA 4,169,0,133,253,96
                          :rem 52
740 DATA 198,254,16,4,169,24
                          :rem 111
750 DATA 133,254,96,230,254,16
    5                     :rem 255
760 DATA 254,201,25,208,4,169
                          :rem 150
770 DATA 0,133,254,96,32,193
                          :rem 103
780 DATA 194,165,251,160,0,145
                          :rem 200
790 DATA 163,169,212,24,101,16
    4                     :rem 248
800 DATA 133,164,165,252,145,1
    63                    :rem 41
810 DATA 96,169,4,133,164,165
                          :rem 160
820 DATA 253,24,105,7,133,163
                          :rem 142
830 DATA 166,254,160,0,32,230
                          :rem 138
840 DATA 194,32,230,194,32,230
                          :rem 194
850 DATA 194,32,237,194,32,230
                          :rem 202
860 DATA 194,32,230,194,32,237
                          :rem 203
870 DATA 194,96,138,10,170,152
                          :rem 207
880 DATA 42,168,96,24,138,101
                          :rem 158
890 DATA 163,133,163,152,101,1
    64                    :rem 39
900 DATA 133,164,96       :rem 172
```

Program 2: Kaleidoscope—VIC Version

```
10 POKE56,28:CLR:FORI=0TO7:REA
   DM(I):NEXT:DATA1,4,25,128,2
   ,10,60,255             :rem 151
20 POKE36879,25:PRINT"{BLK}":G
   OSUB450                :rem 35
30 REM * ML ROUTINE ADDRESSES
   {SPACE}*               :rem 248
40 KAL=7169:A=7201:CHAR=251:X=
   253:Y=254              :rem 211
50 SEED=KAL+126:POKESEED,255*R
   ND(-TI)+1:REM * SEED RANDOM
    # GEN *              :rem 135
60 POKESEED+1,256*RND(1):POKEX
   ,0:POKEY,0:POKECHAR,160:GOS
   UB270                  :rem 67
70 REM * INTRO PAGE *     :rem 72
80 PRINT"{CLR}{5 DOWN}
   {6 SPACES}WELCOME TO
   {2 DOWN}":PRINT"{4 SPACES}U
   CCCCCCCCCCCCI"         :rem 191
90 PRINT"{4 SPACES}-KALEIDOSCO
   PE-"                   :rem 103
100 PRINT"{4 SPACES}J*********
    ***K{4 DOWN}":PRINT"HIT A
    {SPACE}KEY TO CONTINUE"
                          :rem 93
110 GOSUB290:POKEA,25:GOTO330
                          :rem 243
120 REM * MAIN LOOP *     :rem 42
130 SYSKAL:FORI=1TOD:NEXT:GETA
    $:IFA$=""THEN130      :rem 148
140 V=VAL(A$):IFA$="0"THEND=1
                          :rem 129
150 IFV>0THEND=2.4↑V      :rem 225
160 IFA$="Q"THENEND       :rem 99
170 FORI=0TO7:IFA$=CHR$(133+I)
    THENPOKEA,M(I)        :rem 137
180 NEXTI:IFA$="B"THENGOSUB250
                          :rem 88
190 IFA$="C"THENGOSUB270
                          :rem 154
200 IFA$=CHR$(147)THENPRINTCHR
    $(147):GOTO130        :rem 98
210 IFA$="H"THEN330       :rem 21
220 IFA$=" "THENGOSUB290
                          :rem 83
230 GOTO130               :rem 98
240 REM * BLACK AND WHITE *
                          :rem 127
250 POKE7197,1:RETURN     :rem 21
260 REM * COLOR *         :rem 79
270 POKE7197,7:RETURN     :rem 29
280 REM * HIT ANY *       :rem 159
290 GETA$:IFA$<>""THEN290
                          :rem 150
300 GETA$:IFA$=""THEN300
                          :rem 73
310 RETURN                :rem 116
320 REM * HELP MESSAGE *
                          :rem 251
330 PRINT"{CLR}TO CONTROL THE
    {SPACE}DISPLAY,TYPE THESE
    {SPACE}CHARACTERSWHILE THE
     KALEIDOSCOPEIS ";    :rem 32
350 PRINT"RUNNING:"       :rem 196
360 PRINT"{DOWN}{RVS}F1-F8
    {OFF}:ALTER COMPLEXITY"
                          :rem 1
370 PRINT"{RVS}0-9{OFF}
    {2 SPACES}:ALTER SPEED"
                          :rem 200
380 PRINT"{DOWN}{RVS}B{OFF}
    {4 SPACES}:BLACK AND WHITE
    "                     :rem 78
390 PRINT"{DOWN}{RVS}C{OFF}
    {4 SPACES}:8 COLORS":PRINT
    "{DOWN}{RVS}SPACE{OFF}:FRE
    EZE DISPLAY"          :rem 230
400 PRINT"{DOWN}{RVS}CLR{OFF}
    {2 SPACES}:CLEAR SCREEN":P
    RINT"{DOWN}{RVS}H{OFF}
    {4 SPACES}:HELP!"     :rem 232
410 PRINT"{DOWN}{RVS}Q{OFF}
    {4 SPACES}:QUIT{DOWN}"
                          :rem 250
420 PRINT" HIT ANY KEY TO STAR
    T{4 SPACES}THE KALEIDOSCOP
    E";:GOSUB290:PRINTCHR$(147
    )                     :rem 231
430 GOTO130               :rem 100
440 REM * LOAD ML ROUTINES *
                          :rem 2
450 PRINTCHR$(147)"...LOADING
    {SPACE}ML"            :rem 121
460 S=0:C=7169:FORI=CTOC+231:R
    EADX:POKEI,X:S=S+X:NEXT
                          :rem 121
470 IFS<>25910THENPRINT"ERROR
    {SPACE}IN DATA STATEMENTS"
    :END                  :rem 76
480 RETURN                :rem 124
490 DATA 173,33,28,133,165,32
                          :rem 150
500 DATA 34,28,32,91,28,32
                          :rem 250
510 DATA 34,28,32,91,28,198
                          :rem 56
520 DATA 165,208,240,238,0,28
                          :rem 144
530 DATA 173,0,28,41,7,133
                          :rem 246
540 DATA 252,96,128,32,44,28
                          :rem 105
550 DATA 32,66,28,32,44,28
                          :rem 2
560 DATA 96,32,173,28,32,75
                          :rem 59
570 DATA 28,32,173,28,32,83
                          :rem 54
580 DATA 28,32,173,28,32,75
                          :rem 56
590 DATA 28,32,173,28,96,165
                          :rem 115
600 DATA 253,164,254,133,254,1
    32                    :rem 36
610 DATA 253,96,169,20,56,229
                          :rem 160
620 DATA 253,133,253,96,169,20
                          :rem 202
630 DATA 56,229,254,133,254,96
                          :rem 211
640 DATA 32,110,28,144,7,32
                          :rem 38
650 DATA 110,28,144,28,176,35
                          :rem 150
660 DATA 32,110,28,144,43,176
                          :rem 145
670 DATA 50,14,128,28,46,127
                          :rem 102
680 DATA 28,144,8,173,128,28
                          :rem 111
690 DATA 73,45,141,128,28,96
                          :rem 114
700 DATA 59,172,198,253,16,4
                          :rem 108
710 DATA 169,20,133,253,96,230
                          :rem 197
720 DATA 253,165,253,201,21,20
    8                     :rem 239
730 DATA 4,169,0,133,253,96
                          :rem 52
740 DATA 198,254,16,4,169,20
                          :rem 107
750 DATA 133,254,96,230,254,16
    5                     :rem 255
760 DATA 254,201,21,208,4,169
                          :rem 146
770 DATA 0,133,254,96,32,194
                          :rem 104
780 DATA 28,165,251,160,0,145
                          :rem 148
```

```
790 DATA 163,169,120,24,101,16
    4                       :rem 246
800 DATA 133,164,165,252,145,1
    63                      :rem 41
810 DATA 96,169,30,133,164,165
                            :rem 207
820 DATA 253,24,105,1,133,163
                            :rem 136
830 DATA 166,254,160,0,169,22
                            :rem 148
840 DATA 133,2,32,221,28,198
                            :rem 97
850 DATA 2,208,249,96,24,138
                            :rem 111
860 DATA 101,163,133,163,152,1
    01                      :rem 27
870 DATA 164,133,164,96
                            :rem 121
```

Program 3: Kaleidoscope—Plus/4 And 16 Version

```
10 POKE56,60:CLR:FORI=0TO7:REA
   DM(I):NEXT:DATA1,2,4,10,25,
   60,128,255
20 FORI=1TO8:KEYI,CHR$(132+I):
   NEXT:COLOR0,2,3:COLOR4,2,3:
   PRINT"{BLK}":GOSUB450
30 REM * ML ROUTINE ADDRESSES
   {SPACE}*
40 KAL=15617:A=1565l:CH=3:X=5:
   Y=6
50 SEED=KAL+128:POKESEED,255*R
   ND(-TI)+1:REM * SEED RANDOM
   # GEN *
60 POKESEED+1,256*RND(1):POKEX
   ,0:POKEY,0:POKECH,160:GOSUB
   270
70 REM * INTRO PAGE *
80 PRINT"{CLR}{5 DOWN}
   {12 SPACES}WELCOME TO
   {2 DOWN}":PRINT"{10 SPACES}
   UCCCCCCCCCCCCI"
90 PRINT"{10 SPACES}-KALEIDOSC
   OPE-"
100 PRINT"{10 SPACES}J********
    ****K{4 DOWN}":PRINT"
    {5 SPACES}HIT ANY KEY TO C
    ONTINUE"
110 GOSUB290:POKEA,25:GOTO330
120 REM * MAIN LOOP *
130 SYSKAL:FORI=1TOD:NEXT:GETA
    $:IFA$=""THEN130
140 V=VAL(A$):IFA$="0"THEND=1
150 IFV>0THEND=2.4↑V
160 IFA$="Q"THENEND
170 FORI=0TO7:IFA$=CHR$(133+I)
    THENPOKEA,M(I)
180 NEXTI:IFA$="B"THENGOSUB250
190 IFA$="C"THENGOSUB270
200 IFA$=CHR$(147)THENPRINTCHR
    $(147):GOTO130
210 IFA$="H"THEN330
220 IFA$=" "THENGOSUB290
230 GOTO130
240 REM * BLACK AND WHITE *
250 POKE15645,240:POKE15647,24
    1:RETURN
260 REM * COLOR *
270 POKE15645,0:POKE15647,255:
    RETURN
280 REM * HIT ANY *
290 GETA$:IFA$<>""THEN290
300 GETA$:IFA$=""THEN300
310 RETURN
320 REM * HELP MESSAGE *
330 PRINT"{CLR}{3 SPACES}TO CO
    NTROL THE DISPLAY, TYPE TH
    ESE"
340 PRINT"{3 SPACES}CHARACTERS
     WHILE THE KALEIDOSCOPE"
350 PRINT"{14 SPACES}IS RUNNIN
    G"
360 PRINT"{2 DOWN}F1 THROUGH F
    8 : CONTROL COMPLEXITY
    {DOWN}"
370 PRINT" 0 THROUGH{2 SPACES}
    9 : CONTROL SPEED{DOWN}"
380 PRINT"{6 SPACES}B
    {7 SPACES}: BLACK AND WHIT
    E{DOWN}"
390 PRINT"{6 SPACES}C
    {7 SPACES}: 120 COLORS":PR
    INT"{DOWN}{4 SPACES}SPACE
    {5 SPACES}: FREEZE DISPLAY
    "
400 PRINT"{DOWN}{5 SPACES}CLR
    {6 SPACES}: CLEAR SCREEN":
    PRINT"{DOWN}{6 SPACES}H
    {7 SPACES}: HELP!"
410 PRINT"{DOWN}{6 SPACES}Q
    {7 SPACES}: QUIT{2 DOWN}"
420 PRINT" HIT ANY KEY TO STAR
    T THE KALEIDOSCOPE":GOSUB2
    90:PRINTCHR$(147)
430 GOTO130
440 REM * LOAD ML ROUTINES *
450 PRINTCHR$(147)"...LOADING
    {SPACE}ML"
460 S=0:C=15617:FORI=CTOC+250:
    READX:POKEI,X:S=S+X:NEXT
470 IFS<>23347THENPRINT"ERROR
    {SPACE}IN DATA STATEMENTS"
    :END
480 RETURN
490 DATA 173,35,61,133,162,32
500 DATA 36,61,32,93,61,32
510 DATA 36,61,32,93,61,198
520 DATA 162,208,240,238,0,61
530 DATA 173,0,61,9,240,41
540 DATA 241,133,4,96,25,32
550 DATA 46,61,32,68,61,32
560 DATA 46,61,96,32,175,671
570 DATA 32,77,61,32,175,61
580 DATA 32,85,61,32,175,61
590 DATA 32,77,61,32,175,61
600 DATA 96,165,5,164,6,133
610 DATA 6,132,5,96,169,24
620 DATA 56,229,5,133,5,96
630 DATA 169,24,56,229,6,133
640 DATA 6,96,32,112,61,144
650 DATA 7,32,112,61,144,28
660 DATA 176,35,32,112,61,144
670 DATA 43,176,50,14,130,61
680 DATA 46,129,61,144,8,173
690 DATA 130,61,73,45,141,130
700 DATA 61,96,11,194,198,5
710 DATA 16,4,169,24,133,5
720 DATA 96,230,5,165,5,201
730 DATA 25,208,4,169,0,133
740 DATA 5,96,198,6,16,4
750 DATA 169,24,133,6,96,230
760 DATA 6,165,6,201,25,208
770 DATA 4,169,0,133,6,96
780 DATA 32,196,61,165,3,160
790 DATA 0,145,160,169,252,24
800 DATA 101,161,133,161,165,4
810 DATA 145,160,96,169,12,133
820 DATA 161,165,5,24,105,7
830 DATA 133,160,166,6,160,0
840 DATA 32,233,61,32,233,61
850 DATA 32,233,61,32,240,61
860 DATA 32,233,61,32,233,61
870 DATA 32,240,61,96,138,10
880 DATA 170,152,42,168,96,24
890 DATA 138,101,160,133,160,1
    52
900 DATA 101,161,133,161,96
```

Atom Shoot

(See instructions for Plus/4 and 16 version in article on page 52.)

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: Atom Shoot—64 Version

```
10 POKE53281,0:POKE53280,0:KB=
   198:POKE650,128:CLR:ZZ=1700
   :REM 64 SPECIFIC      :rem 3
20 DIMA%(15,10),B%(15,10),M(50
   ),N(50):DN$="{HOME}{6 DOWN}
   ":FORA=1TO33:DN$=DN$+"
   {RIGHT}":NEXT         :rem 199
30 NS=25:GOSUB460:FORA=1TO15:M
   (A)=A*2+1:N(A)=2:NEXT:FORA=
   16TO25:M(A)=32        :rem 241
40 N(A)=(A-15)*2+1:NEXT:FORA=2
   6TO40:M(A)=31-(A-26)*2:N(A)
   =22:NEXT              :rem 131
50 FORA=41TO50:M(A)=2:N(A)=21-
   (A-41)*2:NEXT:FORA=0TO3:REA
   DDX(A),DY(A):NEXT     :rem 156
60 FORA=1TO7:READMR(A):NEXT:DA
   TA -1,0,1,0,0,-1,0,1,27,78,
   27,78,177,57,147      :rem 199
70 FORA=1TO4:READMS(A):NEXT:DA
```


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```
   TA110,109,110,109:GOSUB420
                              :rem 85
80 FORS=1TONS:S$=CHR$(64+S):PR
   INTDN$"{7}{OFF} WHAT
   {2 SPACES}{2 DOWN}{6 LEFT}N
   OW?{2 SPACES}":GOSUB590
                              :rem 248
90 GETA$:ON-(A$="G")-2*(A$="S"
   )-3*(A$="Q")GOTO100,270,330
   :GOTO90                    :rem 130
100 PRINT"{HOME}{3 RIGHT}{GRN}
   ";:FORA=65TO79:PRINTCHR$(A
   )" ";:NEXT:POKEKB,0
                              :rem 230
110 PRINTDN$"{7} WHICH{2 DOWN}
   {5 LEFT}COLUMN"    :rem 39
120 GETA$:IFA$<"A"ORA$>"O"THEN
   120                        :rem 96
130 X1=ASC(A$)-64:GOSUB560
                              :rem 211
140 PRINT"{HOME}{3 DOWN}{GRN}"
   ;:FORA=0TO9:PRINTRIGHT$(ST
   R$(A),1);"{2 DOWN}{LEFT}";
   :NEXT:POKEKB,0     :rem 186
150 PRINTDN$"{7} WHICH{2 DOWN}
   {5 LEFT} ROW{2 SPACES}"
                              :rem 85
160 GETA$:IFA$<"0"ORA$>"9"THEN
   160                        :rem 65
170 PRINT"{HOME}{3 DOWN}";:FOR
   A=1TO20:PRINT" {DOWN}
   {LEFT}";:NEXT:Y1=VAL(A$)+1
   :W$="↑"            :rem 182
180 PRINT"{HOME}{3 SPACES}";:F
   ORA=1TO4:PRINTCHR$(MS(A))"
   ";:NEXT:Z=4:T1=X1:T2=Y1:G
   OSUB490            :rem 10
190 X1=T1:Y1=T2:GOSUB560:IFB%(
   X1,Y1)<>0ANDMR(X)=A%(X1,Y1
   )THENS=S-1:NEXT    :rem 98
200 B=54-S*2:IFA%(X1,Y1)=MR(X)
   THENB%(X1,Y1)=1:GOTO230
                              :rem 54
210 X1=X1*2+1:Y1=Y1*2+1:PRINT"
   {8}";:N$="{+}":GOSUB410
                              :rem 224
220 PRINTDN$"{7} MISSED
   {2 DOWN}{6 LEFT}-"B/2"
   {LEFT} ";:SC=SC-B/2:GOTO26
   0                          :rem 180
230 SC=SC+B:GOSUB570:X1=X1*2+1
   :Y1=Y1*2+1:PRINT"{8}";:GOS
   UB410              :rem 117
240 PRINTDN$"{7}"B"{LEFT} PTS
   {SPACE}{2 DOWN}{6 LEFT}
250 IFG=25THENSC=SC+200-S*5:PR
   INT"{HOME}{RVS}"SPC(15)"YO
   U SOLVED IT!":GOSUB590:GOT
   O360               :rem 66
260 FORTD=1TOZZ:NEXT:S=S-1:NEX
   T                  :rem 73
270 Z=50:W$=S$:GOSUB490:rem 85
280 N$=S$:M=INT((M(X)-1)/2)-(M
   (X)=2):N=INT(N(X)/2)+(N(X)
   =22)               :rem 22
290 GOSUB390:GOSUB400:X1=M:Y1=
   N:GOSUB390         :rem 247
300 ND=3*4↑D:IFA%(X1,Y1)<>0THE
   ND=((A%(X1,Y1)ANDND)/(4↑D)
   )                  :rem 1
310 X1=X1+DX(D):Y1=Y1+DY(D):IF
   (X1>0)AND(X1<16)AND(Y1>0)A
   ND(Y1<11)THEN300   :rem 178
320 M=X1+DX(D):N=Y1+DY(D):PRIN
   T"{RED}";:GOSUB400:PRINT"
   {YEL}";:NEXT       :rem 189
330 PRINT"{7}":FORX=1TO15:FORY
   =1TO10:X1=X:Y1=Y   :rem 143
340 IFA%(X1,Y1)<>0ANDB%(X1,Y1)
   =0THENGOSUB570:X1=X1*2+1:Y
   1=Y1*2+1:GOSUB410  :rem 27
350 NEXTY,X           :rem 180
360 PRINTDN$" PLAY {2 DOWN}
   {5 LEFT}AGAIN?":POKEKB,0
                              :rem 122
370 GETA$:ON-(A$="Y")-2*(A$="N
   ")GOTO10,380:GOTO370
                              :rem 239
380 POKE2025,0:PRINT"{CLR}":EN
   D                  :rem 158
390 D=-((X<=50)AND(X>=41))-2*(
   (X>25)AND(X<41))-3*((X>=1)
   AND(X<=15)):RETURN:rem 104
400 X1=M*2-2*DX(D)+1:Y1=N*2-2*
   DY(D)+1:GOSUB410:RETURN
                              :rem 68
410 PRINT"{HOME}";:FORA=1TOY1:
   PRINT"{DOWN}";:NEXT:PRINTS
   PC(X1)N$;:RETURN   :rem 207
420 NM=25:FORA=1TONM:B=MR(INT(
   RND(1)*4)+1)       :rem 232
430 C=INT(RND(1)*15)+1:D=INT(R
   ND(1)*10)+1        :rem 233
440 IFA%(C,D)<>0THEN430 :rem 1
450 A%(C,D)=B:NEXT:RETURN
                              :rem 21
460 PRINT"{CLR}{8}":FORA=1TO10
   :PRINT:PRINT:PRINT"
   {2 RIGHT}";:FORB=1TO15:PRI
   NT" {RVS} {OFF}";  :rem 63
470 NEXTB,A           :rem 137
480 PRINT DN$"{GRN}{6 DOWN}
   {RIGHT}{RVS}G{OFF}UESS
   {2 DOWN}{5 LEFT}{RVS}S
   {OFF}HOOT{2 DOWN}{5 LEFT}
   {RVS}Q{OFF}UIT{2 DOWN}
   {4 LEFT}{7}SCORE":RETURN
                              :rem 51
490 PRINT"{YEL}":X=1    :rem 12
500 X1=M(X):Y1=N(X):N$=W$:GOSU
   B410               :rem 252
510 GETA$:ON-(A$=",")-2*(A$=".
   ")-3*(A$=CHR$(13))GOTO520,
   530,550:GOTO510    :rem 198
520 X=X-1-Z*(X=1):GOTO540
                              :rem 182
530 X=X+1+Z*(X=Z)      :rem 208
540 N$=" ":GOSUB410:GOTO500
                              :rem 227
550 N$=" ":GOSUB410:RETURN
                              :rem 246
560 PRINT"{HOME}";:FORA=1TO40:
   PRINT" ";:NEXT:RETURN
                              :rem 106
570 FORA=1TO4:IFMR(A)=A%(X1,Y1
   )THENP=A           :rem 51
580 NEXT:N$=CHR$(MS(P)):RETURN
                              :rem 114
590 POKEKB,0:X1=34:Y1=20:N$=""
   :GOSUB410:PRINTSC"{LEFT} "
   :RETURN            :rem 84
```

Program 2: Atom Shoot—VIC Version

John Krause, Assistant Technical Editor

```
10 A=RND(-TI):POKE0,99:POKE371
   54,127             :rem 72
20 POKE36879,8:POKE36878,15:DI
   MA%(9,9):Z=128     :rem 230
30 R=4:C=4:R1=4:C1=4:G=87:H=6:
   E=7725:F=38445     :rem 217
40 FORA=1TO5          :rem 210
50 B=INT(RND(1)*8)+1:O=INT(RND
   (1)*8)+1           :rem 106
60 IFA%(B,O)THEN50    :rem 253
70 A%(B,O)=1:NEXT:PRINT"{CLR}B
   EAMS:"V"{5 SPACES}LOW:"PEEK
   (0)                :rem 110
80 PRINT"{HOME}{DOWN}{BLU}U*
   {R}*************{R}*I
                              :rem 28
90 PRINT"-{GRN}Z{BLU}-"TAB(18)
   "-{GRN}Z{BLU}-     :rem 143
100 PRINT"{Q}*+**************
   +*{W}              :rem 20
110 FORA=1TO8:PRINT"-{RIGHT}-W
   W W W W W W W-{RIGHT}-
                      :rem 82
120 PRINT"- -"TAB(18)"-{RIGHT}
   -":NEXT            :rem 67
130 PRINT"{UP}{Q}*+**********
   ****+*{W}          :rem 168
140 PRINT"-{GRN}Z{BLU}-"TAB(18
   )"-{GRN}Z{BLU}-    :rem 187
150 PRINT"J*{E}**************
   {E}*K              :rem 252
160 IFLTHEN660        :rem 61
170 PRINT"{PUR}{RVS} {OFF}
   {BLU} HIT{2 SPACES}{RED}
   {RVS} {OFF}{BLU} MISS
   {2 SPACES}{YEL}{RVS} {OFF}
   {BLU} REFL{HOME}   :rem 67
180 P=PEEK(37152)AND128:IFP=0T
   HENC=C+1           :rem 224
190 P=PEEK(37151)      :rem 158
200 IF(PAND8)=0THENR=R+1
                      :rem 166
210 IF(PAND16)=0THENC=C-1
                      :rem 186
220 IF(PAND4)=0THENR=R-1
                      :rem 166
230 IFR<0THENR=0       :rem 208
240 IFR>9THENR=9       :rem 229
250 IFC<0THENC=0       :rem 180
260 IFC>9THENC=9       :rem 201
270 D=E+44*R+C+C        :rem 74
280 POKEE+44*R1+C1+C1,G:POKEF+
   44*R1+C1+C1,H       :rem 160
290 R1=R:C1=C:G=PEEK(D):H=PEEK
   (F+44*R+C+C)        :rem 185
300 POKEE+44*R+C+C,43:POKEF+44
   *R+C+C,5            :rem 128
310 IF(PAND32)THEN180  :rem 196
320 IFG=32THEN470      :rem 215
330 IFG=81THEN780      :rem 224
340 IFG<>87THEN180      :rem 30
350 G=81:H=1:A=240:GOSUB810
                       :rem 22
360 I=I+1:IFA%(R,C)THENL=L+1
                      :rem 101
370 POKED,81:POKED+30720,1
                      :rem 211
380 IFI<5THEN180       :rem 172
390 IFL<5THEN660       :rem 179
400 PRINT"{21 DOWN}{5 SPACES}Y
   OU GOT IT!{5 SPACES}{UP}"
                        :rem 0
410 FORA=1TO10          :rem 47
420 FORB=250TO240STEP-1:POKE36
   876,B:NEXT         :rem 196
430 FORB=240TO250:POKE36876,B:
   NEXT               :rem 43
440 NEXT:POKE36876,0   :rem 170
450 IFPEEK(0)>VTHENPOKE0,V
                      :rem 114
460 GOTO750            :rem 111
470 A=225:GOSUB810      :rem 5
480 P=R:Q=C:DR=0:DC=0:T=0:TI$=
   "000000":V=V+1:PRINT"
   {HOME}{6 RIGHT}"V   :rem 41
490 IFR=0THENDR=1      :rem 30
500 IFR=9THENDR=-1     :rem 76
510 IFC=0THENDC=1      :rem 249
520 IFC=9THENDC=-1      :rem 48
530 GOTO560            :rem 108
540 IFP>0ANDP<9ANDQ>0ANDQ<9THE
   N560               :rem 115
550 Z=Z+1:G=Z:H=2:GOSUB640:U=4
   4*P+Q+Q:POKEE+U,G:POKEF+U,
   H:GOTO280          :rem 59
560 RR=P+DR:CC=Q+DC    :rem 141
570 IFA%(RR,CC)=1THENG=160:H=4
   :GOSUB640:GOTO280   :rem 68
```

```
580 IFDRTHENN=1:M=0:GOTO600
                        :rem 170
590 M=1:N=0             :rem 78
600 S=0:IFA%(RR+M,CC+N)=1THEND
    R=-M:DC=-N:S=1      :rem 123
610 IFA%(RR-M,CC-N)=1THENDR=M:
    DC=N:S=S+1          :rem 170
620 IFS=2OR(SANDT=0)THENG=160:
    H=7:GOSUB640:GOTO280
                        :rem 99
630 P=P+DR:Q=Q+DC:T=1:GOTO540
                        :rem 10
640 IFTI<60THEN640      :rem 49
650 RETURN              :rem 123
660 PRINT"{21 DOWN}{4 SPACES}Y
    OU MISSED IT{4 SPACES}{UP}
    "                   :rem 194
670 FORA=1TO20          :rem 56
680 FORB=220-ATO160-ASTEP-8:PO
    KE36876,B:NEXT      :rem 173
690 FORB=160-ATO220-ASTEP8:POK
    E36876,B:NEXT       :rem 129
700 NEXT:POKE36876,0    :rem 169
710 FORR=1TO8:FORC=1TO8
                        :rem 199
720 G=87:H=6:IFA%(R,C)THENG=81
    :H=1                :rem 206
730 POKEE+44*R+C+C,G:POKEF+44*
    R+C+C,H             :rem 122
740 NEXT:NEXT           :rem 83
750 PRINT"{3 SPACES}HIT FIRE B
    UTTON{UP}"          :rem 229
760 IF(PEEK(37151)AND32)THEN76
    0                   :rem 248
770 RUN20               :rem 245
780 G=87:H=6:A=235:GOSUB810
                        :rem 44
790 I=I-1:IFA%(R,C)THENL=L-1
                        :rem 112
800 GOTO180             :rem 106
810 POKE36876,A:FORA=0TO99:NEX
    T:POKE36876,0:RETURN
                        :rem 141
```

The Farm Game

(Article on page 44.)

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: The Farm Game—64 Version

```
10 BO=7:BG=9:CH=1:GOSUB3100:PO
   KE53272,23           :rem 77
20 CLR:GOSUB3110:FG=0:PRINT"
   {4 DOWN}HOW LONG WILL YOU M
   ANAGE YOUR FARM";    :rem 113
30 INPUTQQ$:QQ=VAL(QQ$):IFQQ=0
   THENGOSUB2930        :rem 33
40 IFFG<>0THEN20        :rem 187
50 FORZZ=1TOQQ:GOSUB2110:GOSUB
   2150:IFZZ=1THENGOSUB2190
                        :rem 25
60 BO=7:BG=6:CH=1:GOSUB3100
                        :rem 82
70 PRINT"{CLR}{RVS} YEAR:{OFF}
   ";ZZ:PRINT"{RVS} PLANTING S
   EASON SELECTION: {OFF}
                        :rem 92
80 PRINTTAB(5)"{2 DOWN}F1 KEY.
   ..MARKET NEWS        :rem 1
90 PRINTTAB(5)"F3 KEY...YOUR F
   INANCIAL STATUS      :rem 153
100 PRINTTAB(5)"F5 KEY...PLANT
    ING                 :rem 104
110 PRINTTAB(5)"F7 KEY...SELL
    {SPACE}CROPS ON FUTURES
                        :rem 144
120 PRINTTAB(8)"{2 DOWN}WHAT I
    S YOUR SELECTION?   :rem 72
130 GOSUB2950           :rem 228
140 IFASC(A$)<133ORASC(A$)>136
    THEN130             :rem 77
150 AA=ASC(A$)-132:ONAAGOSUB11
    50,1370,1520,1890   :rem 46
160 IFAA=3THEN180       :rem 224
170 GOTO60              :rem 55
180 BO=7:BG=7:CH=6:GOSUB3100
                        :rem 139
190 PRINT"{CLR}{7 DOWN}":PRINT
    TAB(10)"YOUR CROPS ARE GRO
    WING.               :rem 96
200 FX=0:FORJ=1TO3:FX=FX+(TS(J
    )*INT((BP(J)*FP(J))*100+.5
    )/100):NEXT         :rem 126
210 FX=INT(FX*100+.5)/100:SB=0
                        :rem 141
220 FORJ=1TO3:SB=SR(J)+SB:NEXT
                        :rem 142
230 FORJ=1TO3:SR(J)=SR(J)-TS(J
    ):NEXT              :rem 233
240 GOSUB2200:GOSUB2360:rem 95
250 GT=0:FORJ=1TO3:GT=GT+(TY(J
    )*INT(YP(J)*100+.5)/100):N
    EXT                 :rem 235
260 PT=0:FORJ=1TO3:PT=(FU(J)*T
    A(J))+PT:NEXT:PT=INT(PT*GA
    *100+.5)/100        :rem 82
270 BO=2:BG=2:CH=1:GOSUB3100
                        :rem 124
280 PRINT"{CLR}":PRINTTAB(5)"
    {RVS}{3 SPACES}HARVEST TIM
    E ON THE FARM{3 SPACES}
    {OFF}               :rem 88
290 GOSUB3020:PRINT"{RVS}CROP
    {OFF}{5 SPACES}{RVS}SELLIN
    G PRICE{OFF}{4 SPACES}
    {RVS}YIELD{OFF}     :rem 97
300 FORJ=1TO3:RR=TA(J):IFRR=0T
    HENRR=1             :rem 110
310 TM=YP(J):GOSUB3030:YP$=TM$
    :YP(J)=VAL(TM$)     :rem 243
320 TM=TY(J):GOSUB3030:TY$=TM$
    :TY(J)=VAL(TM$)     :rem 0
330 PRINTN$(J);TAB(13)YP$;TAB(
    33-LEN(TY$))INT(TY(J)):NEX
    T                   :rem 184
340 PRINT"{DOWN}IT IS NOW TIME
     TO PAY YOUR BILLS AND TO
    {SPACE}SELL YOUR CROPS.":G
    OSUB3010            :rem 207
350 PRINT"CURRENT BANK BALANCE
    ";:TM=BA:GOSUB3030:BA$=TM$
    :BA=VAL(TM$)        :rem 58
360 PRINTTAB(33-LEN(BA$))BA$
                        :rem 95
370 PRINT"FUTURES CROP CHECK";
    :TM=FX:GOSUB3030:FX$=TM$:P
    RINTTAB(33-LEN(FX$))FX$
                        :rem 80
380 PRINT"TOTAL YIELD";:TM=GT:
    GOSUB3030:GT$=TM$:GT=VAL(T
    M$)                 :rem 219
390 PRINTTAB(33-LEN(GT$))GT$
                        :rem 146
400 PRINT"LOAN PAYMENT DUE";:T
    M=INT((LO/3)*100+.5)/100:G
    OSUB3030            :rem 113
410 PRINTTAB(33-LEN(TM$))TM$:L
    P=INT(VAL(TM$)*100+.5)/100
                        :rem 232
420 PRINT"HARVESTING COSTS";:T
    M=HV:GOSUB3030:HV$=TM$:PRI
    NTTAB(33-LEN(HV$))HV$
                        :rem 147
430 HV=INT(VAL(TM$)*100+.5)/10
    0                   :rem 176
440 PRINT"COST FOR 200 ACRES";
    :TM=INT(CE*100+.5)/100*200
    :GOSUB3030:CE$=TM$:rem 205
450 PRINTTAB(33-LEN(CE$))CE$
                        :rem 105
460 PRINT"FUEL EXPENSE";:TM=PT
    :GOSUB3030:PT$=TM$:PT=INT(
    VAL(TM$)*100+.5)/100
                        :rem 131
470 PRINTTAB(33-LEN(PT$))PT$
                        :rem 163
480 PRINT"OVERHEAD EXPENSE";:T
    M=OV:GOSUB3030:OV$=TM$:PRI
    NTTAB(33-LEN(OV$))OV$
                        :rem 148
490 OV=INT(VAL(TM$)*100+.5)/10
    0                   :rem 189
500 PRINT"CROP STORAGE FEES";:
    TM=(12*SB*0.015):GOSUB3030
    :SB$=TM$            :rem 171
510 SB=INT(VAL(TM$)*100+.5)/10
    0                   :rem 166
520 PRINTTAB(33-LEN(SB$))SB$:G
    OSUB3010            :rem 255
530 PRINT"{RVS}TOTAL ASSETS=
    {OFF}";:TM=BA+FX+GT:GOSUB3
    030:AA$=TM$         :rem 104
540 PRINTTAB(33-LEN(AA$))AA$
                        :rem 93
550 PRINT"{RVS}TOTAL DEBITS=
    {OFF}";             :rem 198
560 TM=LP+HV+OV+PT+SB+(CE*200)
    :GOSUB3030:DT$=TM$:DT=VAL(
    TM$)                :rem 125
570 PRINTTAB(33-LEN(DT$))DT$:G
    OSUB2940            :rem 21
580 FORJ=1TO3:IFTY(J)=0THEN730
                        :rem 89
590 PRINT"{CLR}HOW MANY BUSHEL
    S OF ";N$(J);" DO YOU WISH
    ":PRINT"TO SELL?    :rem 221
600 PRINT"YOU HAVE A MAXIMUM O
    F ";TY(J);" TO SELL.
                        :rem 221
610 FG=0:X$="":INPUTX$:IFX$=""
    THEN590             :rem 161
620 X=VAL(X$)           :rem 221
630 IFX>TY(J)THENPRINT"YOU DON
    'T HAVE ";X;"BUSHELS!":GOS
    UB3000:GOTO590      :rem 218
640 PRINTX;"BUSHELS OF ";N$(J)
    ;" WOULD SELL":PRINT"FOR $
    ";:TM=X*YP(J):GOSUB3030
                        :rem 218
650 PRINTTM$:GOSUB3020:rem 108
660 PRINT"IS ";X;"BUSHELS OF "
    ;N$(J);" OKAY?      :rem 94
670 PRINT"PRESS {RVS}F1{OFF} T
    O CHANGE, {RVS}F3{OFF} TO
    {SPACE}SELL         :rem 217
680 GOSUB2950           :rem 238
690 IFA$=CHR$(133)THEN590
                        :rem 134
700 IFA$<>CHR$(134)THEN680
                        :rem 188
710 BA=BA+(INT(X*YP(J)*100+.5)
    /100)               :rem 98
720 SR(J)=INT(TY(J)-X+SR(J))
                        :rem 138
730 NEXT                :rem 217
740 BA=INT((BA+FX)*100+.5)/100
                        :rem 61
750 IFLO=0THEN850       :rem 255
760 PRINT"{CLR}HOW MUCH OF YOU
    R LOAN DO YOU       :rem 24
770 PRINT"WISH TO PAY OFF?
    {2 SPACES}MINIMUM PAYMENT
                        :rem 233
780 PRINT"IS $";:TM=INT((LO/3)
    *100+.5)/100:GOSUB3030:PRI
    NTTM$               :rem 34
```

```
790 PRINT"{DOWN}YOU OWE A TOTA
    L OF $";:LO=INT(LO*100+.5)
    /100:PRINTLO          :rem 247
800 FG=0:INPUTA           :rem 157
810 IFA<TMTHENGOTO760     :rem 75
820 IFA>LOTHENA=LO        :rem 139
830 BA=INT((BA-A)*100+.5)/100:
    LO=(LO-A)*1.12::LO=INT(LO*
    100+.5)/100           :rem 102
840 IFLO<0THENLO=0        :rem 105
850 BA=BA-INT(CE*200*100+.5)/1
    00                    :rem 150
860 BA=BA-INT(OV*100+.5)/100
                          :rem 248
870 BA=BA-INT(HV*100+.5)/100
                          :rem 242
880 BA=BA-INT(PT*100+.5)/100
                          :rem 249
890 BA=BA-INT(SB*100+.5)/100
                          :rem 235
900 IFBA<0THENGOSUB2620
                          :rem 144
910 FORJ=1TO3:TY(J)=0:NEXT
                          :rem 119
920 FORJ=1TO3:TS(J)=0:NEXT:NEX
    T                     :rem 235
930 PRINT"{CLR}":PRINTTAB(5)"
    {RVS}{4 SPACES}END OF GAME
     TALLY{3 SPACES}{OFF}
                          :rem 118
940 PRINT"{2 DOWN}CURRENT BANK
     BALANCE = $";:TM=BA:GOSUB
    3030:PRINTTM$:BA=VAL(TM$)
                          :rem 107
950 GOSUB3010             :rem 226
960 PRINT"CROPS IN STORAGE:
                          :rem 187
970 PRINT"{DOWN}{RVS} CROP
    {OFF} {RVS} BUSHELS IN STO
    RAGE {OFF}            :rem 30
980 XX=0                  :rem 190
990 FORJ=1TO3:IFSR(J)<0THENSR(
    J)=0                  :rem 104
1000 PRINTN$(J);:TM=SR(J):GOSU
     B3030                :rem 110
1010 PRINTTAB(22-LEN(TM$));INT
     (SR(J)):XX=XX+SR(J)*YP(J)
     :NEXT                :rem 221
1020 PRINT"{DOWN}STORED CROP C
     ASH VALUE:";:TM=XX:GOSUB3
     030                  :rem 131
1030 PRINTTAB(35-LEN(TM$));"$"
     TM$:XX=VAL(TM$):BA=BA+XX
                          :rem 227
1040 PRINT"AMOUNT OWED TO BANK
     :";:TM=LO:GOSUB3030:PRINT
     TAB(35-LEN(TM$));"$"TM$
                          :rem 225
1050 LO=VAL(TM$):BA=BA-INT(LO*
     100+.5)/100          :rem 33
1060 IFBA>=20000THENZZ=1
                          :rem 151
1070 IFBA<20000THENZZ=2:rem 90
1080 PRINT"GRAND TOTAL IN BANK
     :";:TM=BA:GOSUB3030:BA=VA
     L(TM$)               :rem 64
1090 PRINTTAB(35-LEN(TM$));"$"
     TM$:PRINT            :rem 56
1100 ONZZGOSUB2780,2820:rem 92
1110 PRINT"WOULD YOU LIKE TO T
     RY AGAIN?            :rem 224
1120 GOSUB2950:IFA$="Y"THEN10
                          :rem 172
1130 IFA$<>"N"THEN1120:rem 184
1140 END                  :rem 157
1150 PRINT"{CLR}":BO=1:BG=1:CH
     =0:GOSUB3100         :rem 69
1160 PRINTTAB(8)"{RVS}
     {6 SPACES}NEWS RELEASE
     {5 SPACES}":GOSUB3020
                          :rem 72
1170 IR$=STR$(INT((IR-1)*100))
                          :rem 116
1180 PRINT"YEARLY INFLATION RA
     TE: ";TAB(33)IR$;"%:rem 5
1190 TM=GA:GOSUB3030:GA$=TM$:G
     A=VAL(TM$)           :rem 145
1200 PRINT"FUEL COST (PER GALL
     ON) :";TAB(33-P)"$"GA$
                          :rem 2
1210 TM=HS:GOSUB3030:HS$=TM$:H
     S=VAL(TM$)           :rem 195
1220 PRINT"HERBICIDE COST PER
     {SPACE}UNIT:";TAB(33-P)"$
     "HS$                 :rem 156
1230 TM=IS:GOSUB3030:IS$=TM$:I
     S=VAL(TM$)           :rem 200
1240 PRINT"INSECTICIDE COST PE
     R UNIT:";TAB(33-P)"$"IS$
                          :rem 68
1250 TM=OV:GOSUB3030:OV$=TM$:O
     V=VAL(TM$)           :rem 229
1260 PRINT"OVERHEAD COSTS:";TA
     B(33-P)"$"OV$        :rem 165
1270 TM=CE:GOSUB3030:CE$=TM$
                          :rem 152
1280 PRINT"COST PER ACRE:";TAB
     (33-P)"$"CE$:GOSUB3010
                          :rem 105
1290 PRINTTAB(13)"{RVS}
     {2 SPACES}SEED PRICES
                          :rem 128
1300 PRINT"{DOWN}GRAIN SEED CO
     ST PER BUSHEL        :rem 121
1310 FORJ=1TO3:PRINTN$(J);":";
     :TM=BS(J):GOSUB3030:BS(J)
     =VAL(TM$)            :rem 106
1320 PRINTTAB(33-P)"$"TM$:NEXT
     :PRINT:GOSUB3010     :rem 73
1330 PRINTTAB(10)"{RVS} FUTURE
     S MARKET PRICE ":PRINT
                          :rem 223
1340 FORJ=1TO3:PRINTN$(J);":";
     :TM=BP(J)*FP(J):GOSUB3030
                          :rem 37
1350 PRINTTAB(33-P)"$"TM$:NEXT
     :PRINT               :rem 206
1360 GOSUB2940:RETURN     :rem 51
1370 BO=2:BG=0:CH=1:GOSUB3100
                          :rem 172
1380 PRINT"{CLR}{2 SPACES}
     {RVS}{2 SPACES}YOUR FINAN
     CIAL STATUS{2 SPACES}":GO
     SUB3010              :rem 248
1390 TM=BA:GOSUB3030:BA=VAL(TM
     $)                   :rem 161
1400 PRINT"SAVINGS ACCOUNT BAL
     ANCE:";TAB(25-P)"$"BA
                          :rem 144
1410 TM=LO:GOSUB3030:LO=VAL(TM
     $)                   :rem 202
1420 PRINT"YOU OWE THE BANK:";
                          :rem 114
1430 IFLO=0THENPRINTTAB(28)"--
     ----":GOTO1450       :rem 60
1440 PRINTTAB(25-P)"$"TM$
                          :rem 143
1450 PRINT"{DOWN}":GOSUB3010:P
     RINT"{7 SPACES}{RVS} CROP
     S PRESENTLY IN STORAGE ":
     PRINT:X=0            :rem 134
1460 PRINTTAB(9)"CROP";TAB(20)
     "BUSHELS             :rem 46
1470 FORJ=1TO3:IFSR(J)<1.0THEN
     SR(J)=0              :rem 241
1480 PRINTTAB(8)N$(J);TAB(22)S
     R(J):X=X+SR(J):NEXT
                          :rem 217
1490 PRINT"{2 DOWN}GRAIN STORA
     GE FEE: $";:TM=INT(X*.015
     ):GOSUB3030          :rem 74
1500 PRINTTM$" PER MONTH.
     {2 DOWN}             :rem 247
1510 GOSUB2940:RETURN     :rem 48
1520 BO=5:BG=5:CH=1:GOSUB3100
                          :rem 177
1530 PRINT"{CLR}";TAB(5)"{RVS}
     {2 SPACES}PLANTING TIME O
     N THE FARM{2 SPACES}
                          :rem 41
1540 PRINT"{DOWN}YOU HAVE 200
     {SPACE}ACRES TO PLANT,DIV
     IDED INTO";          :rem 9
1550 PRINT"5 FIELDS OF 40 ACRE
     S EACH.              :rem 12
1560 PRINT"{DOWN}FIELDS 1-3 AR
     E AVERAGE OR SLIGHTLY ABO
     VEAVERAGE YIELDERS.
                          :rem 47
1570 PRINT"{DOWN}FIELDS 4 AND
     {SPACE}5 ARE SLIGHTLY LES
     S THAN{3 SPACES}AVERAGE P
     RODUCERS.            :rem 138
1580 GOSUB3010            :rem 18
1590 PRINTTAB(34)"CROP:rem 193
1600 FORJ=1TO5:PRINT"CROP TO B
     E PLANTED IN FIELD {RVS}"
     ;J                   :rem 193
1610 PRINT"{RVS}1=WHEAT{OFF}
     {3 SPACES}{RVS}2=CORN
     {OFF}{2 SPACES}{RVS}3=SOY
     BEANS{OFF}           :rem 63
1620 GOSUB2950            :rem 25
1630 IFASC(A$)<49ORASC(A$)>51T
     HENGOSUB2980:GOTO1620
                          :rem 31
1640 FL(J)=VAL(A$):PRINT"
     {2 UP}";TAB(33)FL(J):NEXT
                          :rem 106
1650 PRINT"{CLR}ALL YOUR FIELD
     S ARE READY FOR PLANTING.
                          :rem 44
1660 PRINT"THE TOTALS ARE:":FO
     RJ=1TO3:X=0:FORJJ=1TO5
                          :rem 145
1670 IFFL(JJ)=JTHENX=X+40
                          :rem 6
1680 NEXT:TA(J)=X:PRINTX;" ACR
     ES OF ";N$(J);" PLANTED."
     :NEXT                :rem 36
1690 TM=0:FORJ=1TO3:TM=TM+(TA(
     J)*BS(J)*BB(J)):NEXT:TM=I
     NT((TM+.005)*100)/100
                          :rem 189
1700 PRINT"{DOWN}SEED COSTS: "
     ;:GOSUB3030:TM=VAL(TM$):P
     RINTTAB(30-LEN(TM$))"$"TM
     $                    :rem 254
1710 BH=BA:PRINT"{DOWN}BANK BA
     LANCE: $";:BA=BA-TM:TM=BA
     :GOSUB3030           :rem 48
1720 PRINTTAB(30-LEN(TM$))"$"T
     M$                   :rem 49
1730 PRINT"{DOWN}IS THIS OKAY?
      (Y/N)               :rem 121
1740 GOSUB2950:IFA$="N"THENBA=
     BH:GOTO1530          :rem 206
1750 IFA$<>"Y"THEN1740:rem 211
1760 PRINT"{UP}HOW MANY UNITS
     {SPACE}PER ACRE OF INSECT
     ICIDE{2 SPACES}DO YOU WIS
     H TO APPLY?          :rem 50
1770 X$="":INPUTX$:IFX$=""THEN
     1760                 :rem 213
1780 IFASC(X$)<48ORASC(X$)>57T
     HENGOSUB2930:GOTO1760
                          :rem 88
1790 X=VAL(X$)            :rem 22
1800 BA=BA-(X*200*IS):IN=((SQR
     (X)-5)/5)+1          :rem 213
1810 PRINT"HOW MANY UNITS PER
     {SPACE}ACRE OF HERBICIDE
     {SPACE}DO YOU WISH TO APP
     LY?"                 :rem 26
1820 X$="":INPUTX$:IFX$=""THEN
     1810                 :rem 205
1830 IFASC(X$)<48ORASC(X$)>57T
     HENGOSUB2930:GOTO1810
                          :rem 80
```

```
1840 X=VAL(X$)                  :rem 18
1850 BA=BA-(X*200*HS):HE=(((SQ
     R(X)-4.4)/5)+1)  :rem 129
1860 PRINT"{DOWN}PRESENT BANK
     {SPACE}BALANCE: $";:TM=BA
     :GOSUB3030:PRINTTM$:GOSUB
     3000                       :rem 17
1870 IFBA<0THEN2620             :rem 71
1880 RETURN                     :rem 177
1890 PRINT"{CLR}{RVS}
     {3 SPACES}GRAIN FUTURES M
     ARKET SALES{3 SPACES}
                                :rem 1
1900 PRINT"{2 DOWN}YOU HAVE TH
     E FOLLOWING AMOUNTS OF
                                :rem 138
1910 PRINT"GRAIN PRESENTLY IN
     {SPACE}STORAGE:":PRINT
                                :rem 128
1920 FORJ=1TO3:IFSR(J)<0THENSR
     (J)=0                      :rem 146
1930 PRINTN$(J),INT(SR(J));"BU
     SHELS":NEXT:GOSUB3010
                                :rem 155
1940 PRINT"GRAIN MARKET FUTURE
     S PRICES                   :rem 166
1950 FORJ=1TO3:PRINTN$(J),"$";
     :TM=BP(J)*FP(J):GOSUB3030
     :PRINTTM$:NEXT             :rem 12
1960 PRINT"WHICH GRAIN WOULD Y
     OU LIKE TO SELL? :rem 162
1970 PRINT"{RVS}F1{OFF} WHEAT
     {2 SPACES}{RVS}F3{OFF}=CO
     RN{2 SPACES}{RVS}F5{OFF}=
     SOYBEANS{2 SPACES}{RVS}F7
     {OFF}=NONE                 :rem 238
1980 GOSUB2950:IFASC(A$)<133OR
     ASC(A$)>136THEN1980
                                :rem 82
1990 J=ASC(A$)-132::IFJ=4THENR
     ETURN                      :rem 119
2000 IFSR(J)=0THENPRINT"YOU DO
     N'T HAVE ANY ";N$(J);"!":
     GOTO1960                   :rem 14
2010 PRINT"HOW MANY BUSHELS OF
      ";N$(J);" DO YOU :rem 23
2020 PRINT"WANT TO SELL (UP TO
      ";SR(J);" BUSHELS)?
                                :rem 104
2030 INPUTK                     :rem 160
2040 IFK>SR(J)THENPRINT"YOU DO
     N'T HAVE THAT MUCH GRAIN!
     ":GOTO2010                 :rem 65
2050 SR(J)=SR(J)-K:IFSR(J)<0TH
     ENSR(J)=0                  :rem 77
2060 TS(J)=K                    :rem 146
2070 PRINT"WOULD YOU LIKE TO S
     ELL MORE GRAIN?    :rem 91
2080 GOSUB2960:IFA$="Y"THEN189
     0                          :rem 36
2090 IFA$<>"N"THEN2080:rem 196
2100 RETURN                     :rem 163
2110 X=INT((RND(.)*7+1))/100
                                :rem 198
2120 IFX>.05THEN2140    :rem 115
2130 IR=1+X:GOTO2150    :rem 141
2140 IR=1                       :rem 208
2150 FORJ=1TO3:BS(J)=INT(BS(J)
     *IR*100)/100:NEXT  :rem 9
2160 GA=INT(GA*IR*100+.5)/100:
     IS=IS*(IR+.01):HS=HS*IR:O
     V=OV*(IR+.01):HV=HV*IR
                                :rem 26
2170 CE=INT(CE*(IR+.01)*100+.5
     )/100                      :rem 44
2180 FORJ=1TO3:BP(J)=BP(J)*(IR
     -.01):NEXT:RETURN:rem 118
2190 FORJ=1TO3:FP(J)=1.05:NEXT
     :RETURN                    :rem 64
2200 X=RND(.)*(0.99-.01)+.01
                                :rem 125
2210 IFX<.45THENXX=1.0+X:GOTO2
     250                        :rem 233
2220 IFX>.80THENXX=X:GOTO2250
                                :rem 49
2230 IFX>.45ANDX<.5THENXX=1.03
     :GOTO2250          :rem 103
2240 XX=1.0                     :rem 68
2250 X=RND(.)*(.99-.01)+.01
                                :rem 82
2260 IFX<.1THENXX=XX+1+X:GOTO2
     300                        :rem 47
2270 IFX>.75THENXX=XX+X:GOTO23
     00                         :rem 17
2280 IFX>.4ANDX<.5THENXX=XX+1.
     02:GOTO2300        :rem 13
2290 XX=XX+1                    :rem 198
2300 XX=XX/2                    :rem 195
2310 IFX<.2THENIN=IN/2:HE=HE/2
                                :rem 54
2320 SF=IN:IFIN>1.1THENSF=1.1
                                :rem 247
2330 HF=HE:IFHF>1.1THENHF=1.1
                                :rem 207
2340 FORJ=1TO3:TY(J)=0:NEXT
                                :rem 166
2350 FORJ=1TO5:K=FL(J):TY(K)=I
     NT(40*FF(J)*BY(K)*XX*HF*S
     F+TY(K)):NEXT:RETURN
                                :rem 158
2360 FORJ=1TO3:GOSUB2580:DM(J)
     =XX:GOSUB2580:DC(J)=XX:GO
     SUB2580:EM(J)=XX  :rem 203
2370 GOSUB2580:FC(J)=XX:NEXT
                                :rem 223
2380 X=0                        :rem 146
2390 X=0:FORJ=1TO3:X=DM(J)+X:X
     =X+DC(J):X=X+EM(J):X=X+FC
     (J):FA(J)=X/4:X=0:NEXT
                                :rem 245
2400 FORJ=1TO3:YP(J)=FA(J)*BP(
     J):NEXT            :rem 232
2410 X=0:FORJ=1TO3              :rem 59
2420 IFDC(J)>1.05THENXX=.95:GO
     TO2450             :rem 113
2430 IFDC(J)<.9THENXX=1.1:GOTO
     2450                       :rem 7
2440 XX=1                       :rem 232
2450 X=X+XX                     :rem 147
2460 IFEM(J)>1.05THENXX=.95:GO
     TO2490             :rem 132
2470 IFEM(J)<.95THENXX=1.12:GO
     TO2490             :rem 129
2480 XX=1                       :rem 236
2490 X=X+XX             :rem 151
2500 IFFC(J)>1.1THENXX=.8:GOTO
     2530                       :rem 7
2510 IFFC(J)<.97THENXX=1.09:GO
     TO2530             :rem 118
2520 XX=1                       :rem 231
2530 X=X+XX:X=X/3               :rem 27
2540 IFX=1THENX=1.03    :rem 166
2550 FP(J)=X            :rem 146
2560 X=0                        :rem 146
2570 NEXT                       :rem 13
2580 X=RND(.)*(.99-.01)+.01
                                :rem 88
2590 IFX<.45THENXX=X+1:RETURN
                                :rem 116
2600 IFX>.70THENXX=X:RETURN
                                :rem 16
2610 XX=1:RETURN                :rem 1
2620 PRINT"{CLR}{RVS}YOU NEED
     {SPACE}TO BORROW MONEY TO
      KEEP FARMING      :rem 137
2630 PRINT"{2 DOWN}YOUR BALANC
     E IN THE BANK HAS:rem 193
2640 PRINT"DROPPED BELOW $0.
     {2 SPACES}TO MEET YOUR PA
     YMENTS             :rem 146
2650 PRINT"{UP}YOU WILL NEED T
     O BORROW SOME MONEY FROM
     {SPACE}THE BANK (UP TO $5
     0,000).            :rem 213
2660 PRINT"MINIMUM LOAN PAYMEN
     TS ARE ONE-THIRD OF
     {2 SPACES}LOAN DUE AT 12%
      INTEREST.         :rem 108
2670 IF0-BA+LO>50000THEN2860
                                :rem 54
2680 PRINT"{2 DOWN}YOU WILL NE
     ED TO BORROW AT LEAST:":P
     RINT"$";0-(INT(BA*100+.5)
     /100)              :rem 58
2690 PRINT"YOU CAN BORROW UP T
     O $";50000-INT(LO*100+.5)
     /100               :rem 117
2700 PRINT"{DOWN}YOU OWE A GRA
     ND TOTAL OF $";INT(LO*100
     +.5)/100           :rem 24
2710 PRINT"{2 DOWN}HOW MUCH DO
      YOU WISH TO BORROW?
                                :rem 190
2720 INPUTX$:X=VAL(X$):IFVAL(X
     $)=0THEN2720       :rem 54
2730 IFLO+X>50000THENPRINT"SOR
     RY,YOUR CREDIT LINE IS $5
     0,000":GOTO2710    :rem 71
2740 IFX<INT(0-BA+.005)THENPRI
     NT"THAT WILL NOT BE ENOUG
     H, TRY AGAIN":GOTO2710
                                :rem 233
2760 LO=LO+X:BA=INT((BA+X)*100
     +.5)/100:IFLO<0THENLO=0
                                :rem 98
2770 LO=LO*1.12:RETURN  :rem 73
2780 BO=7:BG=4:CH=0:GOSUB3100
                                :rem 186
2790 PRINT"{DOWN}CONGRATULATIO
     NS!!{2 SPACES}YOU HAVE MA
     NAGED THE          :rem 64
2800 PRINT"NEARLY IMPOSSIBLE T
     ASK OF MAKING MONEY
                                :rem 66
2810 PRINT"AT FARMING.
     {2 SPACES}THE BANK CONSID
     ERS YOU A":PRINT"GOOD RIS
     K.":RETURN         :rem 253
2820 BO=6:BG=6:CH=1:GOSUB3100
                                :rem 183
2830 PRINT"YOU HAVE PROVEN YOU
     RSELF A VERY POOR :rem 55
2840 PRINT"FARMER! YOU LOST MO
     NEY, AND NOW YOUR:rem 228
2850 PRINT"FARM MUST BE SOLD T
     O PAY YOUR CREDITORS!":RE
     TURN               :rem 142
2860 GOSUB3000:GOSUB3000:PRINT
     "{CLR}{RVS}{5 SPACES}SORR
     Y, YOU ARE BANKRUPT.
     {11 SPACES}{OFF} :rem 101
2870 PRINT"{2 DOWN}YOU HAVE MA
     NAGED TO RUN YOUR CREDIT
                                :rem 210
2880 PRINT"LINE TO THE LIMIT,
     {SPACE}AND NOW YOU ARE
                                :rem 116
2890 PRINT"BROKE!{2 SPACES}YOU
      OWE CONSIDERABLE BACK TA
     XES                :rem 127
2900 PRINT"AND YOUR FARM WILL
     {SPACE}BE SOLD AT A
                                :rem 137
2910 PRINT"SHERIFF'S AUCTION T
     O PAY YOUR DEBTS.:rem 139
2920 PRINT"{3 DOWN}":GOTO1110
                                :rem 7
2930 FG=1:PRINT"{DOWN}YOU MUST
      ENTER A NUMBER HERE.
     {2 UP}":GOSUB3000:RETURN
                                :rem 62
2940 PRINT"{RVS}{6 SPACES}PRES
     S ANY KEY TO CONTINUE
     {7 SPACES}{OFF}":GOSUB295
     0:RETURN           :rem 206
2950 POKE198,0          :rem 253
2960 GETA$:IFA$=""THEN2960
                                :rem 197
```

```
2970 RETURN                    :rem 178
2980 PRINT"YOU MUST ENTER 1,2,
     OR 3 HERE.":GOSUB3000:RE
     TURN                      :rem 96
2990 PRINT"{UP}{32 SPACES}{UP}
     ":RETURN                  :rem 225
3000 FORT=1TO2000:NEXT:RETURN
                               :rem 100
3010 PRINT"----------------
     ----------------":RETU
     RN                        :rem 93
3020 PRINT"****************
     ****************":RETU
     RN                        :rem 48
3030 TM$=STR$(INT(TM*100+.5)/1
     00)                       :rem 28
3040 P=0:FORA=1TOLEN(TM$)
                               :rem 236
3050 IFMID$(TM$,A,1)=".":THENP=
     A-1                       :rem 63
3060 NEXT:IFP=0THENTM$=TM$+CHR
     $(46):P=1                 :rem 99
3070 IFMID$(TM$,(LEN(TM$)-2),1
     )=CHR$(46)THEN3090
                               :rem 143
3080 TM$=TM$+CHR$(48):GOTO3040
                               :rem 181
3090 RETURN                    :rem 172
3100 POKE53280,BO:POKE53281,BG
     :POKE646,CH:RETURN
                               :rem 173
3110 PRINT"{CLR}{4 DOWN}";TAB(
     13)"{RVS} THE FARM GAME
                               :rem 9
3120 FORJ=1TO3:READN$(J):NEXT:
     FORJ=1TO3:READBP(J):NEXT:
     FORJ=1TO3:READFU(J):NEXT
                               :rem 118
3130 FORJ=1TO3:READBY(J):NEXT:
     FORJ=1TO3:READBB(J):NEXT:
     FORJ=1TO3:READBS(J):NEXT
                               :rem 140
3140 READBA:READLO:READGA:READ
     CE:FORJ=1TO3:SR(J)=0:NEXT
     :READIS:HS=IS             :rem 195
3150 FORJ=1TO5:READFF(J):NEXT:
     FORJ=1TO3:READDF(J):NEXT:
     FORJ=1TO3:READCF(J):NEXT
                               :rem 123
3160 FORJ=1TO3:READEF(J):NEXT:
     FORJ=1TO3:READOF(J):NEXT:
     READOV:HV=2*OV            :rem 243
3170 BA$=STR$(BA):RETURN
                               :rem 186
3180 DATA"WHEAT","CORN","SOYBE
     ANS",2.80,2.33,6.30,50,85
     ,60                       :rem 46
3190 DATA62,100,31,1.5,.334,1.
     5,7,65,7.25,20000,0,1,70
                               :rem 108
3200 DATA1,1.1,1.03,1,.98,.9,.
     8,1.1,.82,1,1.1,1:rem 253
3210 DATA1,.5,1.1,.6,.25,1.12,
     2000                      :rem 137
```

Program 2: The Farm Game—VIC Version

(Note: 16K memory expansion required)

```
10 PRINTCHR$(14):BG=127:CH=0:G
   OSUB3040                    :rem 242
20 CLR:GOSUB3050:FG=0:PRINTTAB
   (2)"{4 DOWN}HOW LONG WILL Y
   OU":PRINT"MANAGE YOUR FARM
                               :rem 124
30 INPUTQQ$:QQ=VAL(QQ$):IFQQ=0
   THENGOSUB2870               :rem 36
40 IFFG<>0THEN20               :rem 187
50 FORZZ=1TOQQ:GOSUB2040:GOSUB
   2080:IFZZ=1THENGOSUB2130
                               :rem 23
60 BG=221:CH=0:GOSUB3040
                               :rem 116
70 PRINT"{CLR}{RVS}YEAR:{OFF}"
   ;ZZ:PRINT"{RVS}SEASON SELEC
   TION: {OFF}                 :rem 127
80 PRINT"{2 DOWN}F1 KEY=MARKET
    NEWS                       :rem 215
90 PRINT"F3 KEY=YOUR FINANCES
                               :rem 77
100 PRINT"F5 KEY=PLANTING
                               :rem 190
110 PRINT"F7 KEY=SELL FUTURES
                               :rem 66
120 PRINT"{2 DOWN}WHAT IS YOUR
     CHOICE?                   :rem 237
130 GOSUB2890                  :rem 231
140 IFASC(A$)<133ORASC(A$)>136
    THEN130                    :rem 77
150 AA=ASC(A$)-132:ONAAGOSUB11
    10,1330,1480,1830          :rem 37
160 IFAA=3THEN180              :rem 224
170 GOTO60                     :rem 55
180 BG=238:CH=1:GOSUB3040
                               :rem 176
190 PRINT"{CLR}{7 DOWN}":PRINT
    "YOUR CROPS ARE GROWING
                               :rem 169
200 FX=0:FORJ=1TO3:FX=FX+(TS(J
    )*INT((BP(J)*FP(J))*100+.5
    )/100):NEXT                :rem 126
210 FX=INT(FX*100+.5)/100:SB=0
                               :rem 141
220 FORJ=1TO3:SB=SR(J)+SB:NEXT
                               :rem 142
230 FORJ=1TO3:SR(J)=SR(J)-TS(J
    ):NEXT                     :rem 233
240 GOSUB2140:GOSUB2300:rem 92
250 GT=0:FORJ=1TO3:GT=GT+TY(J)
    *INT(YP(J)*100+.5)/100:NEX
    T                          :rem 154
260 PT=0:FORJ=1TO3:PT=(FU(J)*T
    A(J))+PT:NEXT:PT=INT(PT*GA
    *100+.5)/100               :rem 82
270 BG=248:CH=0:GOSUB3040
                               :rem 176
280 PRINT"{CLR}":PRINTTAB(2)"
    {RVS}{3 SPACES}HARVEST TIM
    E{3 SPACES}{OFF}           :rem 49
290 GOSUB2960:PRINT"{2 SPACES}
    {RVS}CROP{OFF}{2 SPACES}
    {RVS}PRICE{OFF}{3 SPACES}
    {RVS}YIELD{OFF}            :rem 95
300 FORJ=1TO3:RR=TA(J):IFRR=0T
    HENRR=1                    :rem 110
310 TM=YP(J):GOSUB2970:YP$=TM$
    :YP(J)=VAL(TM$)            :rem 255
320 TM=TY(J):GOSUB2970:TY$=TM$
    :TY(J)=VAL(TM$)            :rem 12
330 PRINTN$(J);TAB(8)YP$;:PRIN
    TTAB(24-(LEN(TY$)))INT(TY(
    J)):NEXT                   :rem 164
340 PRINT"{DOWN}IT IS NOW TIME
     TO PAY YOUR BILLS AND TO
    {SPACE}SELLYOUR CROPS.":GO
    SUB2880                    :rem 221
350 PRINT"{CLR}CURRENT BANK BA
    LANCE":TM=BA:GOSUB2970:BA$
    =TM$:BA=VAL(TM$)           :rem 158
360 PRINTTAB(10-LEN(BA$))"$"BA
    $                          :rem 194
370 PRINT"FUTURES CROP CHECK":
    TM=FX:GOSUB2970:FX$=TM$:PR
    INTTAB(10-LEN(FX$))"$"FX$
                               :rem 132
380 PRINT"TOTAL YIELD":TM=GT:G
    OSUB2970:GT$=TM$:GT=VAL(TM
    $)                         :rem 172
390 PRINTTAB(10-LEN(GT$))GT$
                               :rem 141
400 PRINT"LOAN PAYMENT DUE":TM
    =INT((LO/3)*100+.5)/100:GO
    SUB2970                    :rem 66
410 PRINTTAB(10-LEN(TM$))"$"TM
    $:LP=INT(VAL(TM$)*100+.5)/
    100                        :rem 75
420 PRINT"HARVESTING COSTS":TM
    =HV:GOSUB2970:HV$=TM$:PRIN
    TTAB(10-LEN(HV$))"$"HV$
                               :rem 199
430 HV=INT(VAL(TM$)*100+.5)/10
    0                          :rem 176
440 PRINT"COST FOR 200 ACRES":
    TM=INT(CE*200*100+.5)/100:
    GOSUB2970:CE$=TM$          :rem 158
450 PRINTTAB(10-LEN(CE$))"$"CE
    $                          :rem 204
460 PRINT"FUEL EXPENSE":TM=PT:
    GOSUB2970:PT$=TM$:PT=INT(V
    AL(TM$)*100+.5)/100:rem 84
470 PRINTTAB(10-LEN(PT$))"$"PT
    $                          :rem 6
480 PRINT"OVERHEAD EXPENSE":TM
    =OV:GOSUB2970:OV$=TM$:PRIN
    TTAB(10-LEN(OV$))"$"OV$
                               :rem 200
490 OV=INT(VAL(TM$)*100+.5)/10
    0                          :rem 189
500 PRINT"CROP STORAGE FEES":T
    M=(12*SB*0.015):GOSUB2970:
    SB$=TM$                    :rem 124
510 SB=INT(VAL(TM$)*100+.5)/10
    0                          :rem 166
520 PRINTTAB(10-LEN(SB$))"$"SB
    $                          :rem 228
530 GOSUB2880                  :rem 234
540 PRINT"{CLR}{RVS}TOTAL ASSE
    TS={OFF}":TM=BA+FX+GT:GOSU
    B2970:AA$=TM$              :rem 205
550 PRINTTAB(10-LEN(AA$))"$"AA
    $                          :rem 193
560 PRINT"{DOWN}{RVS}TOTAL DEB
    ITS={OFF}"                 :rem 157
570 TM=LP+HV+OV+PT+SB+(CE*200)
    :GOSUB2970:DT$=TM$:DT=VAL(
    TM$)                       :rem 138
580 PRINTTAB(10-LEN(DT$))"$"DT
    $:GOSUB2880                :rem 124
590 FORJ=1TO3:IFTY(J)=0THEN750
                               :rem 92
600 PRINT"{CLR}HOW MANY BUSHEL
    S OF ":PRINTN$(J);" DO YOU
    ":PRINT"WANT TO SELL?
                               :rem 96
610 PRINT"YOU HAVE A MAXIMUM O
    F ":PRINTTY(J)" TO SELL.
                               :rem 47
620 FG=0:X$="":INPUTX$:IFX$=""
    THEN620                    :rem 156
630 IFASC(X$)<48ORASC(X$)>57TH
    EN600                      :rem 40
640 X=VAL(X$)                  :rem 223
650 IFX>TY(J)THEN600           :rem 205
660 PRINTX;"BUSHELS OF ":PRINT
    N$(J);" WOULD SELL":PRINT"
    FOR $";:TM=X*YP(J):GOSUB29
    70                         :rem 116
670 PRINTTM$:GOSUB2960:rem 122
680 PRINT"IS ";X;"BUSHELS OK?
                               :rem 106
690 PRINT"{DOWN}PRESS: {RVS}F1
    {OFF} TO CHANGE":PRINT"
    {7 SPACES}{RVS}F3{OFF} TO
    {SPACE}SELL                :rem 5
700 GOSUB2890                  :rem 234
710 IFA$=CHR$(133)THEN600
                               :rem 119
720 IFA$<>CHR$(134)THEN700
                               :rem 183
730 BA=BA+(INT(X*YP(J)*100+.5)
    /100)                      :rem 100
740 SR(J)=INT(TY(J)-X+SR(J))
                               :rem 140
750 NEXT                       :rem 219
760 BA=INT((BA+FX)*100+.5)/100
                               :rem 63
```

```
770 IFLO=0THEN870          :rem 3
780 PRINT"{CLR}HOW MUCH OF YOU
    R LOAN DO YOU WISH TO PAY
    {4 SPACES}OFF?     :rem 252
790 PRINT"MINIMUM PAYMENT IS:"
                           :rem 1
800 TM=INT((LO/3)*100+.5)/100:
    GOSUB2970:PRINTTAB(3)TM$
                           :rem 124
810 PRINT"{DOWN}YOU OWE A TOTA
    L OF":PRINT"$"LO       :rem 7
820 FG=0:INPUTA            :rem 159
830 IFA<TMTHEN780          :rem 22
840 IFA>LOTHENA=LO         :rem 141
850 BA=INT((BA-A)*100+.5)/100:
    LO=(LO-A)*1.12:LO=INT(LO*1
    00+.5)/100             :rem 46
860 IFLO<0THENLO=0         :rem 107
870 BA=INT((BA-(CE*200)-OV-HV-
    PT-SB)*100)/100        :rem 220
880 IFBA<0THENGOSUB2560
                           :rem 154
890 FORJ=1TO3:TY(J)=0:NEXT
                           :rem 126
900 FORJ=1TO3:TS(J)=0:NEXT:NEX
    T                      :rem 233
910 PRINT"{CLR}{RVS}{2 SPACES}
    END OF GAME TALLY
    {3 SPACES}{OFF}        :rem 12
920 PRINT"{DOWN}CURRENT BANK B
    ALANCE = $";:TM=BA:GOSUB29
    70:PRINTTM$:BA=VAL(TM$)
                           :rem 100
930 GOSUB2950              :rem 236
940 PRINT"CROPS IN STORAGE:
                           :rem 185
950 PRINT"{RVS} CROP {OFF}
    {2 SPACES}{RVS} BUSHELS
    {OFF}                  :rem 223
960 XX=0                   :rem 188
970 FORJ=1TO3:IFSR(J)<0THENSR(
    J)=0                   :rem 102
980 PRINTN$(J);TAB(10)SR(J):XX
    =XX+SR(J)*YP(J):NEXT
                           :rem 104
990 PRINT"STORED CROP CASH VAL
    UE:$";:TM=XX:GOSUB2970
                           :rem 129
1000 PRINTTM$:XX=VAL(TM$):BA=B
     A+XX                  :rem 139
1010 GOSUB2880:PRINT"{CLR}AMOU
     NT OWED TO BANK:$";:TM=LO
     :GOSUB2970            :rem 76
1020 PRINTTM$:LO=VAL(TM$):BA=I
     NT(BA-LO)             :rem 161
1030 IFBA>=20000THENZZ=1
                           :rem 148
1040 IFBA<20000THENZZ=2:rem 87
1050 PRINT"{DOWN}GRAND TOTAL I
     N BANK=$";:TM=BA:GOSUB297
     0:PRINTTM$:BA=VAL(TM$):PR
     INT                   :rem 212
1060 ONZZGOSUB2720,2760:rem 94
1070 PRINT"WOULD YOU LIKE TO T
     RY AGAIN?             :rem 229
1080 GOSUB2890:IFA$="Y"THEN10
                           :rem 180
1090 IFA$<>"N"THEN1080:rem 194
1100 END                   :rem 153
1110 PRINT"{CLR}":BG=25:CH=0:G
     OSUB3040              :rem 65
1120 PRINT"{RVS}{5 SPACES}NEWS
      RELEASE{5 SPACES}":GOSUB
     2960                  :rem 240
1130 IR$=STR$(INT((IR-1)*100))
                           :rem 112
1140 PRINT"INFLATION RATE: ";T
     AB(16)IR$;"%"         :rem 172
1150 TM=GA:GOSUB2970:GA$=TM$:G
     A=VAL(TM$)            :rem 153
1160 PRINT"FUEL COST:";TAB(16-
     P)"$"GA$              :rem 19
1170 TM=HS:GOSUB2970:HS$=TM$:H
     S=VAL(TM$)            :rem 212
1180 PRINT"HERBICIDE:";TAB(16-
     P)"$"HS$              :rem 66
1190 TM=IS:GOSUB2970:IS$=TM$:I
     S=VAL(TM$)            :rem 217
1200 PRINT"INSECTICIDE:";TAB(1
     6-P)"$"IS$            :rem 225
1210 TM=OV:GOSUB2970:OV$=TM$:O
     V=INT(VAL(TM$)*100+.5)/10
     0                     :rem 50
1220 PRINT"OVERHEAD COSTS:":PR
     INTTAB(16-P)"$"OV$:rem 46
1230 TM=CE:GOSUB2970:CE$=TM$
                           :rem 160
1240 PRINT"COST PER ACRE:"TAB(
     15-P)"$"CE$:GOSUB2880:PRI
     NT"{CLR}"             :rem 214
1250 PRINTTAB(4)"{RVS} SEED PR
     ICES "                :rem 110
1260 PRINT"{DOWN}GRAIN SEED CO
     ST PER{3 SPACES}BUSHEL:
                           :rem 184
1270 PRINT:FORJ=1TO3:PRINTN$(J
     );":";:TM=BS(J):GOSUB2970
     :BS(J)=VAL(TM$)       :rem 66
1280 PRINTTAB(15-P)"$"TM$:NEXT
                           :rem 9
1290 PRINT"{DOWN}{RVS} FUTURES
      MARKET PRICE ":PRINT
                           :rem 108
1300 FORJ=1TO3:PRINTN$(J);":"
     ;:TM=BP(J)*FP(J):GOSUB2970
                           :rem 45
1310 PRINTTAB(15-P)"$"TM$:NEXT
     :PRINT                :rem 202
1320 GOSUB2880:RETURN      :rem 50
1330 BG=10:CH=1:GOSUB3040
                           :rem 162
1340 PRINT"{CLR}{RVS}YOUR FINA
     NCIAL STATUS ":GOSUB2950
                           :rem 0
1350 TM=BA:GOSUB2970:BA=VAL(TM
     $)                    :rem 169
1360 PRINT"SAVINGS ACCOUNT:":P
     RINTTAB(15-P)"$"BA
                           :rem 186
1370 TM=LO:GOSUB2970:LO=VAL(TM
     $)                    :rem 219
1380 PRINT"YOU OWE THE BANK:"
                           :rem 60
1390 IFLO=0THENPRINTTAB(15)"--
     ----":GOTO1410        :rem 57
1400 PRINTTAB(15-P)"$"TM$
                           :rem 138
1410 GOSUB2950:PRINT"
     {2 SPACES}{RVS} CROPS IN
     {SPACE}STORAGE ":PRINT:X=
     0                     :rem 44
1420 PRINTTAB(2)"CROP";TAB(14)
     "BUSHELS              :rem 38
1430 FORJ=1TO3:IFSR(J)<1.0THEN
     SR(J)=0               :rem 237
1440 PRINTN$(J);TAB(17)SR(J):X
     =X+SR(J):NEXT         :rem 121
1450 PRINT"{2 DOWN}GRAIN STORA
     GE FEE:":PRINT"$";:TM=INT
     (X*.015):GOSUB2970:rem 93
1460 PRINTTM$" PER MONTH.
                           :rem 218
1470 GOSUB2880:RETURN      :rem 56
1480 BG=29:CH=0:GOSUB3040
                           :rem 177
1490 PRINT"{CLR}{RVS}
     {5 SPACES}PLANTING TIME
     {4 SPACES}"           :rem 208
1500 PRINT"{DOWN}YOU HAVE 200
     {SPACE}ACRES TO PLANT,DIV
     IDED INTO";           :rem 5
1510 PRINT" 5{2 SPACES}FIELDS
     {SPACE}OF 40 ACRES
     {4 SPACES}EACH.       :rem 8
1520 PRINT"{DOWN}FIELDS 1-3 AR
     E AVERAGEOR SLIGHTLY ABOV
     E{5 SPACES}AVERAGE YIELDE
     RS.                   :rem 43
1530 PRINT"{DOWN}FIELDS 4 AND
     {SPACE}5 ARE{4 SPACES}SLI
     GHTLY LESS THAN{4 SPACES}
     AVERAGE PRODUCERS.":GOSUB
     2880                  :rem 52
1540 FORJ=1TO5:PRINT"{CLR}CROP
      TO BE PLANTED IN FIELD "
     ;J                    :rem 69
1550 PRINTTAB(5)"{DOWN}{RVS}1=
     WHEAT{3 SPACES}":PRINTTAB
     (5)"{RVS}2=CORN{4 SPACES}
     {OFF}":PRINTTAB(5)"{RVS}3
     =SOYBEANS{OFF}        :rem 238
1560 PRINT"{DOWN}YOUR CHOICE?"
     :GOSUB2890            :rem 244
1570 IFASC(A$)<49ORASC(A$)>51T
     HENGOSUB2920:GOTO1560
                           :rem 31
1580 FL(J)=VAL(A$):NEXT:rem 74
1590 PRINT"{CLR}ALL YOUR FIELD
     S ARE{3 SPACES}READY FOR
     {SPACE}PLANTING.      :rem 47
1600 PRINT"YOU HAVE:":FORJ=1TO
     3:X=0:FORJJ=1TO5      :rem 28
1610 IFFL(JJ)=JTHENX=X+40
                           :rem 0
1620 NEXT:TA(J)=X:PRINTX;" ACR
     ES OF ";N$(J):NEXT
                           :rem 105
1630 TM=0:FORJ=1TO3:TM=TM+(TA(
     J)*BS(J)*BB(J)):NEXT:TM=I
     NT((TM+.005)*100)/100
                           :rem 183
1640 PRINT"{DOWN}SEED COSTS: "
     ;:GOSUB2970:TM=VAL(TM$):P
     RINTTAB(15-LEN(TM$))"$"TM
     $                     :rem 16
1650 BH=BA:PRINT"{DOWN}BANK BA
     LANCE:":BA=BA-TM:TM=BA:GO
     SUB2970               :rem 224
1660 PRINTTAB(10-LEN(TM$))"$"T
     M$                    :rem 50
1670 PRINT"{DOWN}IS THIS OKAY?
      (Y/N)                :rem 124
1680 GOSUB2890:IFA$="N"THENBA=
     BH:GOTO1490           :rem 217
1690 IFA$<>"Y"THEN1680:rem 217
1700 PRINT"{CLR}{UP}HOW MANY U
     NITS PER{4 SPACES}ACRE OF
      INSECTICIDE DOYOU WISH T
     O APPLY?              :rem 191
1710 X$="":INPUTX$:IFX$=""THEN
     1700                  :rem 201
1720 IFASC(X$)<48ORASC(X$)>57T
     HENGOSUB2870:GOTO1710
                           :rem 80
1730 X=VAL(X$)             :rem 16
1740 BA=BA-X*200*IS:IN=((SQR(X
     )-5)/5)+1             :rem 135
1750 PRINT"{DOWN}HOW MANY UNIT
     S PER{4 SPACES}ACRE OF HE
     RBICIDE DO{2 SPACES}YOU W
     ISH TO APPLY?"        :rem 46
1760 X$="":INPUTX$:IFX$=""THEN
     1750                  :rem 211
1770 IFASC(X$)<48ORASC(X$)>57T
     HENGOSUB2870:GOTO1750
                           :rem 89
1780 X=VAL(X$)             :rem 21
1790 BA=BA-X*200*HS:HE=(((SQR(
     X)-4.4)/5)+1)         :rem 51
1800 PRINT"{DOWN}PRESENT BANK
     {SPACE}BALANCE: $";:TM=BA
     :GOSUB2970:PRINTTM$:GOSUB
     2940                  :rem 35
1810 IFBA<0THEN2560        :rem 68
1820 RETURN                :rem 171
1830 PRINT"{CLR} {RVS}GRAIN FU
     TURES MARKET          :rem 3
1840 PRINT"{DOWN}YOU HAVE THE
```

```
    {SPACE}FOLLOWINGAMOUNTS O
    F GRAIN IN{3 SPACES}STORA
    GE:                    :rem 211
1850 FORJ=1TO3:IFSR(J)<0THENSR
    (J)=0                  :rem 148
1860 PRINTN$(J);:TM$=STR$(SR(J
    )):PRINTTAB(15-LEN(TM$))S
    R(J):NEXT:GOSUB2950
                           :rem 72
1870 PRINTTAB(3)"FUTURES PRICE
    S                      :rem 206
1880 FORJ=1TO3:PRINTN$(J),"$";
    :TM=BP(J)*FP(J):GOSUB2970
    :PRINTTM$:NEXT         :rem 26
1890 PRINT"WHICH GRAIN WOULD Y
    OU LIKE TO SELL? :rem 164
1900 PRINT"{RVS}F1{OFF} WHEAT
    {5 SPACES}{RVS}F3{OFF}=CO
    RN{2 SPACES}{RVS}F5{OFF}=
    SOYBEANS{2 SPACES}{RVS}F7
    {OFF}=NONE             :rem 231
1910 GOSUB2890:IFASC(A$)<133OR
    ASC(A$)>136THEN1910
                           :rem 71
1920 J=ASC(A$)-132::IFJ=4THENR
    ETURN                  :rem 112
1930 IFSR(J)=0THENPRINT"YOU DO
    N'T HAVE ANY":PRINTN$(J);
    "!":GOTO1890           :rem 167
1940 PRINT"{CLR}HOW MANY BUSHE
    LS OF ":PRINTN$(J);" DO Y
    OU                     :rem 65
1950 PRINT"WANT TO SELL?":PRIN
    T"(UP TO ";SR(J);" BUSHEL
    S)"                    :rem 160
1960 INPUTK                :rem 171
1970 IFK>SR(J)THENPRINT"YOU DO
    N'T HAVE THAT{3 SPACES}MU
    CH GRAIN!":GOSUB2940: GOT
    O1940                  :rem 224
1980 SR(J)=SR(J)-K:IFSR(J)<0TH
    ENSR(J)=0              :rem 88
1990 TS(J)=K               :rem 157
2000 PRINT"{DOWN}WOULD YOU LIK
    E TO SELLMORE GRAIN?
                           :rem 101
2010 GOSUB2890:IFA$="Y"THEN183
    0                      :rem 25
2020 IFA$<>"N"THEN2010:rem 182
2030 RETURN                :rem 165
2040 X=INT((RND(.)*7+1))/100
                           :rem 200
2050 IFX>.05THEN2070       :rem 119
2060 IR=1+X:GOTO2080       :rem 145
2070 IR=1                  :rem 210
2080 FORJ=1TO3:BS(J)=BS(J)*IR:
    NEXT                   :rem 84
2090 GA=INT(GA*IR*100+.5)/100:
    IS=IS*(IR+.01):HS=HS*IR:O
    V=OV*(IR+.01):HV=HV*IR
                           :rem 28
2100 CE=CE*(IR+.01)        :rem 224
2110 CE=INT(CE*(IR+.01)*100+.5
    )/100                  :rem 38
2120 FORJ=1TO3:BP(J)=BP(J)*(IR
    -.01):NEXT:RETURN:rem 112
2130 FORJ=1TO3:FP(J)=1.05:NEXT
    :RETURN                :rem 58
2140 X=RND(0)*(0.99-.01)+.01
                           :rem 130
2150 IFX<.45THENXX=1.0+X:GOTO2
    190                    :rem 239
2160 IFX>.80THENXX=X:GOTO2190
                           :rem 55
2170 IFX>.45ANDX<.5THENXX=1.03
    :GOTO2190              :rem 109
2180 XX=1.0                :rem 71
2190 X=RND(0)*(.99-.01)+.01
                           :rem 87
2200 IFX<.1THENXX=XX+1+X:GOTO2
    240                    :rem 44
2210 IFX>.75THENXX=XX+X:GOTO22
    40                     :rem 14
2220 IFX>.4ANDX<.5THENXX=XX+1.
    02:GOTO2240            :rem 10
2230 XX=XX+1               :rem 192
2240 XX=XX/2               :rem 198
2250 IFX<.2THENIN=IN/2:HE=HE/2
                           :rem 57
2260 SF=IN:IFIN>1.1THENSF=1.1
                           :rem 250
2270 HF=HE:IFHE>1.1THENHF=1.1
                           :rem 209
2280 FORJ=1TO3:TY(J)=0:NEXT
                           :rem 169
2290 FORJ=1TO5:K=FL(J):TY(K)=I
    NT(40*FF(J)*BY(K)*XX*HF*S
    F+TY(K)):NEXT:RETURN
                           :rem 161
2300 FORJ=1TO3:GOSUB2520:DM(J)
    =XX:GOSUB2520:DC(J)=XX:GO
    SUB2520:EM(J)=XX       :rem 179
2310 GOSUB2520:FC(J)=XX:NEXT
                           :rem 211
2320 X=0                   :rem 140
2330 X=0:FORJ=1TO3:X=DM(J)+X:X
    =X+DC(J):X=X+EM(J):X=X+FC
    (J):FA(J)=X/4:X=0:NEXT
                           :rem 239
2340 FORJ=1TO3:YP(J)=FA(J)*BP(
    J):NEXT                :rem 235
2350 X=0:FORJ=1TO3         :rem 62
2360 IFDC(J)>1.05THENXX=.95:GO
    TO2390                 :rem 119
2370 IFDC(J)<.9THENXX=1.1:GOTO
    2390                   :rem 13
2380 XX=1                  :rem 235
2390 X=X+XX                :rem 150
2400 IFEM(J)>1.05THENXX=.95:GO
    TO2430                 :rem 120
2410 IFEM(J)<.95THENXX=1.12:GO
    TO2430                 :rem 117
2420 XX=1                  :rem 230
2430 X=X+XX                :rem 145
2440 IFFC(J)>1.1THENXX=.8:GOTO
    2470                   :rem 13
2450 IFFC(J)<.97THENXX=1.09:GO
    TO2470                 :rem 124
2460 XX=1                  :rem 234
2470 X=X+XX:X=X/3          :rem 30
2480 IFX=1THENX=1.03       :rem 169
2490 FP(J)=X               :rem 149
2500 X=0                   :rem 140
2510 NEXT                  :rem 7
2520 X=RND(0)*(.99-.01)+.01
                           :rem 84
2530 IFX<.45THENXX=X+1:RETURN
                           :rem 110
2540 IFX>.70THENXX=X:RETURN
                           :rem 19
2550 XX=1:RETURN           :rem 4
2560 PRINT"{CLR}{RVS}YOU NEED
    {SPACE}TO BORROW
    {4 SPACES}MONEY TO KEEP F
    ARMING.                :rem 186
2570 PRINT"{DOWN}YOUR BALANCE
    {SPACE}IN THE{3 SPACES}BA
    NK HAS DROPPED{6 SPACES}B
    ELOW $0."              :rem 222
2580 PRINT"TO MEET YOUR PAYMEN
    TS                     :rem 140
2590 PRINT"YOU WILL NEED TO
    {6 SPACES}BORROW SOME MON
    EY FROMTHE BANK.":PRINT"(
    UP TO $50,000)         :rem 82
2600 PRINT"MINIMUM LOAN PAYMEN
    TS ARE ONE-THIRD OF LOAN
    {SPACE}DUE AT 12% INTERES
    T."                    :rem 136
2610 GOSUB2880:IF0-BA+LO>50000
    THEN2800               :rem 182
2620 PRINT"{CLR}{DOWN}YOU WILL
     NEED TO{6 SPACES}BORROW
    {SPACE}AT LEAST:":PRINT"$
    ";0-INT(BA*100+.5)/100
                           :rem 101
2630 PRINT"YOU CAN BORROW UP T
    O:":PRINT"$";50000-(INT(L
    O*100+.5)/100)         :rem 5
2640 PRINT"{DOWN}YOU OWE A GRA
    ND TOTAL OF:":PRINT"$";IN
    T(LO*100+.5)/100       :rem 96
2650 PRINT"{2 DOWN}HOW MUCH DO
     YOU WISH{2 SPACES}TO BOR
    ROW?                   :rem 193
2660 X$="":INPUTX$:IFX$=""THEN
    2650                   :rem 211
2670 X=VAL(X$):IFX=0THEN2650
                           :rem 158
2680 IFLO+X>50000THENPRINT"YOU
    R CREDIT LIMIT IS
    {2 SPACES}$50,000":GOTO26
    50                     :rem 218
2690 IFX<INT(0-BA+.005)THENPRI
    NT"THAT WILL NOT BE
    {6 SPACES}ENOUGH, TRY AGA
    IN.":GOTO2650          :rem 30
2700 LO=LO+X:BA=BA+X:IFLO<0THE
    NLO=0                  :rem 198
2710 LO=LO*1.12:RETURN :rem 67
2720 BG=216:CH=0:GOSUB3040
                           :rem 221
2730 PRINT"{DOWN}CONGRATULATIO
    NS!!{5 SPACES}YOU HAVE MA
    NAGED THE{2 SPACES}NEARLY
     IMPOSSIBLE TASKOF";
                           :rem 33
2740 PRINT" MAKING MONEY":PRIN
    T"FARMING. THE BANK":PRIN
    T"CONSIDERS YOU A GOOD
    {2 SPACES}RISK." :rem 154
2750 RETURN                :rem 174
2760 PRINT"{CLR}YOU HAVE PROVE
    N":PRINT"YOURSELF A POOR
    {SPACE}FARM{2 SPACES}MANA
    GER!"                  :rem 245
2770 GOSUB2880:PRINT"{CLR}YOU
    {SPACE}HAVE PROVEN":PRINT
    "YOURSELF A VERY POOR":PR
    INT"FARMER!"           :rem 111
2780 PRINT"{DOWN}YOU LOST MONE
    Y, AND":PRINT"NOW YOUR FA
    RM MUST":PRINT"BE SOLD TO
     PAY YOUR              :rem 52
2790 PRINT"CREDITORS!":RETURN
                           :rem 13
2800 GOSUB2940:GOSUB2940:PRINT
    "{CLR}{RVS}SORRY, YOU'RE
    {SPACE}BANKRUPT{OFF}
                           :rem 47
2810 PRINT"{2 DOWN}YOU HAVE MA
    NAGED TO{3 SPACES}RUN YOU
    R CREDIT LINE          :rem 244
2820 PRINT"TO THE LIMIT, AND N
    OW YOU ARE BROKE!:rem 218
2830 PRINT"{DOWN}YOU OWE CONSI
    DERABLE{2 SPACES}BACK TAX
    ES AND YOUR            :rem 24
2840 PRINT"FARM WILL BE SOLD A
    T A                    :rem 106
2850 PRINT"{UP}SHERIFF'S AUCTI
    ON TO{2 SPACES}PAY YOUR D
    EBTS.                  :rem 31
2860 PRINT"{DOWN}":GOTO1070
                           :rem 237
2870 FG=1:PRINT"{DOWN}YOU MUST
     ENTER A NUMBER HERE.
    {2 UP}":GOSUB2940:RETURN
                           :rem 77
2880 PRINT"{RVS}{4 SPACES}PRES
    S ANY KEY{4 SPACES}{OFF}"
    :GOSUB2890:RETURN :rem 76
2890 POKE198,0             :rem 0
2900 GETA$:IFA$=""THEN2900
                           :rem 185
2910 RETURN                :rem 172
2920 PRINT"YOU MUST ENTER 1,2,
     OR 3 HERE.":GOSUB2940:RE
    TURN                   :rem 102
```

```
2930 PRINT"{UP}{32 SPACES}{UP}
     ":RETURN          :rem 219
2940 FORT=1TO2000:NEXT:RETURN
                       :rem 112
2950 PRINT"-------------------
     --":RETURN        :rem 108
2960 PRINT"*****************
     **":RETURN        :rem 124
2970 TM$=STR$(INT(TM*100+.5)/1
     00)               :rem 40
2980 P=0:FORA=1TOLEN(TM$)
                       :rem 248
2990 IFMID$(TM$,A,1)=". "THENP=
     A-1               :rem 75
3000 NEXT:IFP=0THENTM$=TM$+CHR
     $(46):P=1         :rem 93
3010 IFMID$(TM$,(LEN(TM$)-2),1
     )=CHR$(46)THEN3030
                       :rem 131
3020 TM$=TM$+CHR$(48):GOTO2980
                       :rem 187
3030 RETURN            :rem 166
3040 POKE36879,(BG):POKE646,CH
     :RETURN           :rem 231
3050 PRINT"{CLR}{4 DOWN}";TAB(
     4)"{RVS} THE FARM GAME "
                       :rem 254
3060 FORJ=1TO3:READN$(J):NEXT:
     FORJ=1TO3:READBP(J):NEXT:
     FORJ=1TO3:READFU(J):NEXT
                       :rem 121
3070 FORJ=1TO3:READBY(J):NEXT:
     FORJ=1TO3:READBB(J):NEXT:
     FORJ=1TO3:READBS(J):NEXT
                       :rem 143
3080 READBA:READLO:READGA:READ
     CE:FORJ=1TO3:SR(J)=0:NEXT
     :READIS:HS=IS     :rem 198
3090 FORJ=1TO5:READFF(J):NEXT:
     FORJ=1TO3:READDF(J):NEXT:
     FORJ=1TO3:READCF(J):NEXT
                       :rem 126
3100 FORJ=1TO3:READEF(J):NEXT:
     FORJ=1TO3:READOF(J):NEXT:
     READOV:HV=2*OV    :rem 237
3110 BA$=STR$(BA):RETURN
                       :rem 180
3120 DATA"WHEAT","CORN","SOYBE
     ANS",2.80,2.33,6.30,50,85
     ,60               :rem 40
3130 DATA62,100,31,1.5,.334,1.
     5,7,65,7.25,20000,0,1,70
                       :rem 102
3140 DATA1,1.1,1.03,1,.98,.9,.
     8,1.1,.82,1,1.1,1  :rem 0
3150 DATA1,.5,1.1,.6,.25,1.12,
     2000              :rem 140
```

Program 3: The Farm Game—Substitute Lines For The Plus/4 And 16

```
10 BO=10:BG=10:CH=3:IT=0:GOSUB
   3100:POKE65299,212
15 KEY1,"":KEY2,"":KEY3,"":KEY
   8,""
80 PRINTTAB(5)"{2 DOWN}F1 KEY.
   ...MARKET NEWS
90 PRINTTAB(5)"F2 KEY....YOUR
   {SPACE}FINANCIAL STATUS
100 PRINTTAB(5)"F3 KEY....PLAN
    TING
110 PRINTTAB(5)"HELP KEY..SELL
    CROPS ON FUTURES
130 GOSUB2950:POKE239,0
140 IFA<3ORA>6THEN130
150 AA=A-2:ONAAGOSUB1890,1150,
    1370,1520
160 IFAA=4THEN180
180 BO=8:BG=8:CH=7:IT=0:GOSUB3
    100
270 BO=6:BG=6:CH=2:IT=0:GOSUB3
    100
670 PRINT"PRESS {RVS}F1{OFF} T
    O CHANGE, {RVS}F3{OFF} TO
    {SPACE}SELL
690 IF A=4THEN590
700 IFA<>6THEN680
1120 GOSUB2950:IFA=25THEN10
1130 IFA<>39THEN1120
1150 PRINT"{CLR}":BO=2:BG=2:CH
     =1:GOSUB3100
1370 BO=3:BG=1:CH=2:IT=7:GOSUB
     3100
1620 GOSUB2950:IFA=56THENA=1
1621 IFA=59THENA=2
1622 IFA=8THENA=3
1623 IFA<1ORA>3THENGOSUB2980:G
     OTO1620
1630 REM DELETE THIS LINE
1640 FL(J)=A:PRINT"{2 DOWN}";T
     AB(33)FL(J):NEXT
1740 GOSUB2950:IFA=39THENBA=BH
     :GOTO1530
1750 IFA<>25THEN1740
1770 POKE239,0:INPUTX$:IFASC(X
     $)<48ORASC(X$)>57THENGOSU
     B2930:GOTO1770
1970 PRINT"{RVS}F1{OFF} WHEAT
     {SPACE}{RVS}F2{OFF}=CORN
     {SPACE}{RVS}F3{OFF}=SOYBE
     ANS {RVS}HELP{OFF}=NONE
1980 GOSUB2950:IFA<3ORA>6THEN1
     980
1990 J=A-3:IFJ=0THENRETURN
2080 GOSUB2950:IFA=25THEN1890
2090 IFA<>39THEN2080
2780 BO=8:BG=5:CH=1:GOSUB3100
2950 FORT=1TO50:NEXT:A=PEEK(20
     38):IFA=64THEN2950
2960 REM DELETE THIS LINE
3100 COLOR4,BO:COLOR0,BG:COLOR
     1,CH,IT:RETURN
```

X BASIC

(See instructions in article on page 96 before typing in.)

```
49152 :120,173,087,192,141,004,205
49158 :003,173,088,192,141,005,096
49164 :003,173,089,192,141,006,104
49170 :003,173,090,192,141,007,112
49176 :003,173,091,192,141,008,120
49182 :003,173,092,192,141,009,128
49188 :003,173,093,192,141,010,136
49194 :003,173,094,192,141,011,144
49200 :003,088,096,000,000,000,235
49206 :000,000,000,000,000,000,054
49212 :000,000,000,000,000,000,060
49218 :000,000,000,000,000,000,066
49224 :000,000,000,000,000,000,072
49230 :000,000,000,000,000,000,078
49236 :000,000,000,068,193,216,049
49242 :193,013,194,053,194,083,052
49248 :080,082,065,212,066,082,171
49254 :068,210,083,067,082,069,169
49260 :069,206,081,085,073,212,066
49266 :083,080,082,077,085,076,085
49272 :212,077,079,086,197,083,086
49278 :080,082,073,084,197,065,195
49284 :083,080,082,073,084,197,219
49290 :068,083,080,082,073,084,096
49296 :197,083,073,196,069,078,072
49302 :086,069,076,079,080,197,225
49308 :071,065,084,197,070,082,213
49314 :209,087,065,086,197,086,124
49320 :079,204,070,067,085,212,117
49326 :070,077,079,068,197,070,223
49332 :073,076,084,069,210,070,250
49338 :082,083,206,067,083,069,008
49344 :212,077,085,076,084,201,159
49350 :069,088,084,078,196,076,021
49356 :079,067,065,084,197,067,251
49362 :069,078,084,069,210,072,024
49368 :073,082,069,211,076,073,032
49374 :078,197,072,080,082,078,041
49380 :212,080,076,079,212,084,203
49386 :069,088,212,067,076,069,047
49392 :065,210,067,079,076,210,179
49398 :083,084,073,067,203,066,054
49404 :084,206,000,235,237,237,227
49410 :001,195,121,194,110,194,049
49416 :132,194,146,195,151,194,252
49422 :219,194,171,195,193,195,157
49428 :033,200,159,200,055,200,099
49434 :112,200,254,200,099,201,068
49440 :117,201,164,201,221,201,113
49446 :030,202,183,196,021,196,098
49452 :096,196,001,197,098,197,061
49458 :215,197,213,199,016,198,064
49464 :249,198,030,199,065,199,228
49470 :182,199,134,197,183,197,130
49476 :032,124,165,162,000,160,199
49482 :004,132,015,189,000,002,160
49488 :201,128,176,054,201,032,104
49494 :240,050,133,008,201,034,240
49500 :240,083,036,015,112,040,106
49506 :201,048,144,004,201,060,244
49512 :144,032,132,113,160,000,173
49518 :132,011,136,134,122,202,079
49524 :200,232,189,000,002,056,027
49530 :249,095,192,240,245,201,064
49536 :128,208,053,165,011,024,205
49542 :105,204,164,113,232,200,128
49548 :153,251,001,185,251,001,214
49554 :240,056,056,233,058,240,005
49560 :004,201,073,208,004,133,007
49566 :015,208,172,056,233,085,159
49572 :208,167,133,008,189,000,101
49578 :002,240,221,197,008,240,054
49584 :217,200,153,251,001,232,206
49590 :208,240,166,122,230,011,135
49596 :200,185,094,192,016,250,101
49602 :185,095,192,208,175,189,214
49608 :000,002,016,188,153,253,044
49614 :001,169,001,133,123,169,034
49620 :255,133,122,096,016,048,114
49626 :201,255,240,044,036,015,241
49632 :048,040,201,204,176,003,128
49638 :076,036,167,056,233,203,233
49644 :170,132,073,160,255,202,204
49650 :240,008,200,185,095,192,138
49656 :016,250,048,245,200,185,168
49662 :095,192,048,005,032,071,185
49668 :171,208,245,076,239,166,085
49674 :076,243,166,032,115,000,130
49680 :008,201,204,144,028,205,038
49686 :255,192,176,023,040,032,228
49692 :033,194,076,174,167,056,216
49698 :233,204,010,168,185,003,069
49704 :193,072,185,002,193,072,245
49710 :076,115,000,040,076,231,072
49716 :167,169,000,133,013,032,054
49722 :115,000,008,205,255,192,065
49728 :144,041,205,001,193,176,056
49734 :036,040,072,205,000,193,104
49740 :176,006,032,115,000,032,181
49746 :241,174,104,056,237,255,125
49752 :192,010,168,185,064,193,132
49758 :133,085,185,065,193,133,120
49764 :086,032,084,000,076,141,007
49770 :173,040,076,141,174,169,111
49776 :000,160,016,032,230,195,233
49782 :140,033,208,096,169,000,252
49788 :160,016,032,230,195,140,129
49794 :032,208,096,120,032,083,189
49800 :228,088,096,174,051,192,197
49806 :224,000,240,005,010,202,055
49812 :076,142,194,096,169,000,057
49818 :160,008,032,230,195,140,151
49824 :051,192,169,002,160,000,222
49830 :032,218,195,072,152,072,139
49836 :169,001,160,000,032,218,240
49842 :195,152,072,173,051,192,245
49848 :010,170,104,157,001,208,066
49854 :104,157,000,208,104,032,027
49860 :139,194,072,169,001,032,035
49866 :139,194,073,255,045,016,156
49872 :208,141,016,208,104,013,130
49878 :016,208,141,016,208,096,131
49884 :169,000,160,008,032,230,051
49890 :195,140,051,192,169,001,206
49896 :160,000,032,218,195,152,221
49902 :072,169,000,160,016,032,175
49908 :218,195,152,174,051,192,202
49914 :157,039,208,104,157,248,139
```

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49920 :007,096,169,000,160,008,184
49926 :032,230,195,140,051,192,078
49932 :169,000,160,002,032,218,081
49938 :195,152,072,169,000,160,254
49944 :002,032,218,195,152,072,183
49950 :169,000,160,002,032,218,099
49956 :195,152,072,169,000,160,016
49962 :002,032,218,195,152,032,161
49968 :139,194,072,169,001,032,143
49974 :139,194,073,255,045,028,020
49980 :208,141,028,208,104,013,250
49986 :028,208,141,028,208,104,015
49992 :032,139,194,072,169,001,167
49998 :032,139,194,073,255,045,048
50004 :027,208,141,027,208,104,031
50010 :013,027,208,141,027,208,202
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50088 :141,037,208,096,169,000,051
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50106 :194,013,021,208,141,021,016
50112 :208,096,169,000,160,008,065
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50124 :169,001,032,139,194,073,044
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50148 :236,195,140,083,192,141,191
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50232 :152,072,169,000,160,016,113
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50676 :173,022,208,009,016,141,045
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50700 :096,096,076,008,175,032,239
50706 :158,173,165,013,201,255,215
50712 :208,244,032,166,182,201,033
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50844 :007,177,100,145,098,136,051
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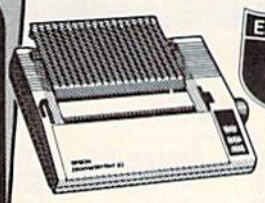

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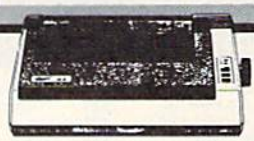

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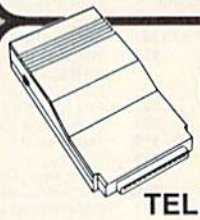

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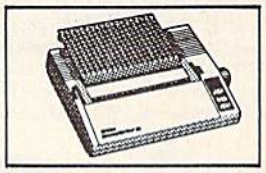

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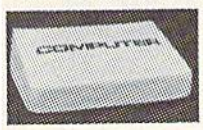

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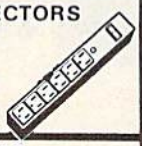

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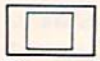
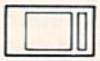
 Regular $49.95

 Plus $59.95

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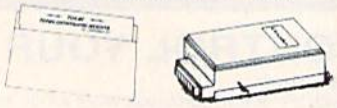

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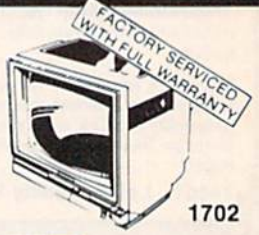

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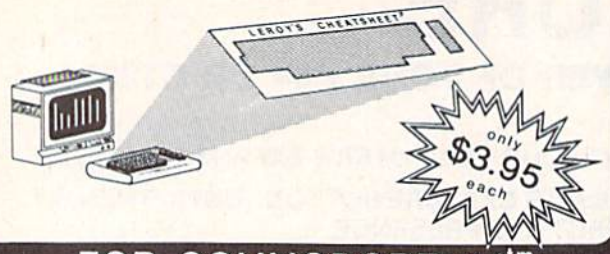

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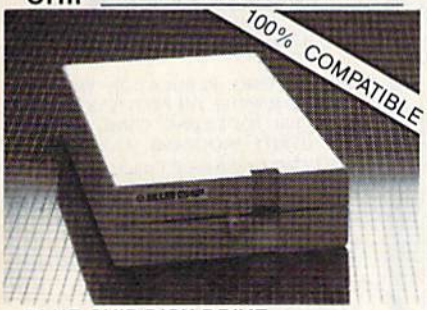

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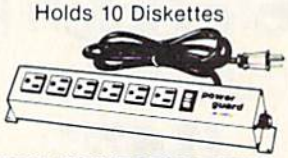

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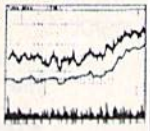

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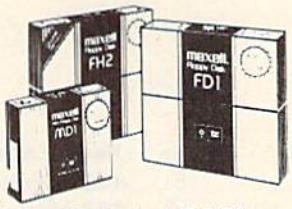

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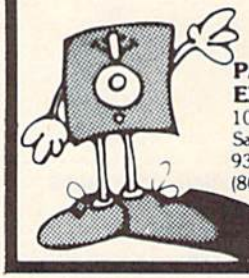

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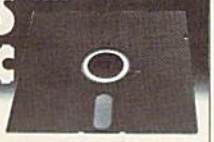

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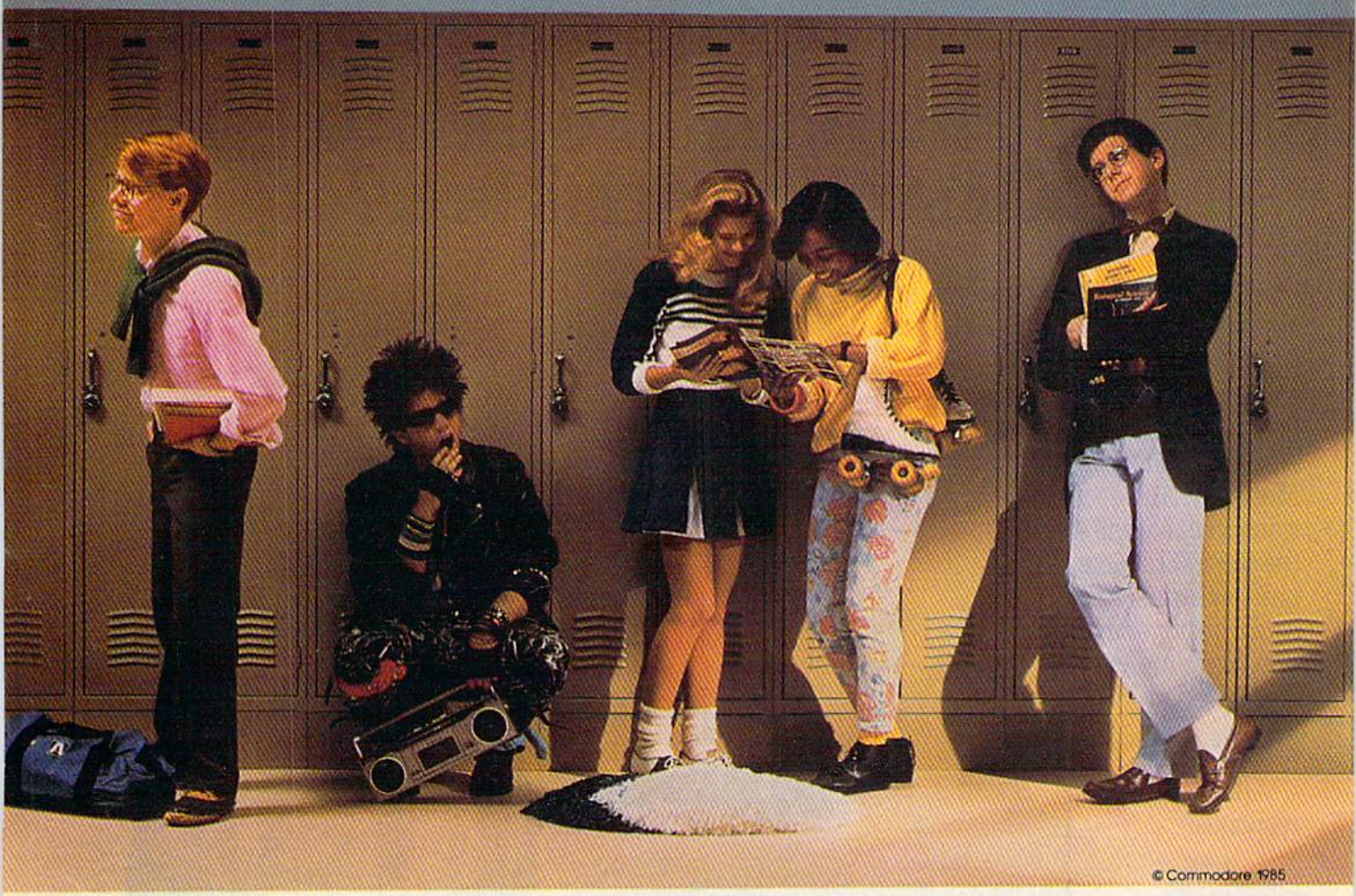

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